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Exercise "Dread Night": Using Allied Medical Publication-8(C) to Estimate Chemical, Biological, Radiological, and Nuclear (CBRN) Casualties

Julia K. Burr
Carl A. Curling
Lucas A. LaViolet

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About This Publication

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Executive Summary

The U.S. Army Office of the Surgeon General tasked the Institute for Defense Analyses (IDA) with planning and conducting the tabletop exercise "Dread Night." The purpose of the exercise was to increase the participants' familiarity and understanding of the casualty estimation methodology contained in *Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties* (hereafter referred to as *AMedP-8(C)*) prior to the submission of *AMedP-8(C)* to North Atlantic Treaty Organization (NATO) member nations for ratification. This exercise was conducted as part of the 31st meeting of the NATO Military Committee Medical Standardization Board Chemical, Biological, Radiological and Nuclear (CBRN) Medical Working Group, held 1–3 February 2010 at NATO headquarters in Brussels, Belgium. Participants included each nation's representatives to the CBRN Medical Working Group and accompanying members of their delegations. This study documents IDA's work on the exercise.

AMedP-8(C) describes a methodology for estimating casualties over time in a user-specified scenario involving a CBRN attack. Development of a casualty estimate comprises three phases: calculation of dose, dosage or insult; estimation of human response; and summation and reporting. Each of these phases was explored over a three-hour period during the course of the exercise.

The exercise provided a constructive learning opportunity for the participants. Members of the U.S. delegation who participated in both the dry run and the exercise clearly came away with a better understanding of the casualty estimation methodology presented in *AMedP-8(C)*. All the comments received from the national delegates immediately following the exercise were very positive and focused on the extent to which their comprehension of the document and the casualty estimation process had been improved by the experience.

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1. Introduction

The U.S. Army Office of the Surgeon General (OTSG) tasked the Institute for Defense Analyses (IDA) with planning and conducting "Dread Night," a tabletop exercise designed to familiarize participants with the casualty estimation methodology contained in *Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties* (*AMedP-8(C)*). This exercise was conducted as part of the 31st meeting of the North Atlantic Treaty Organization (NATO) Military Committee Medical Standardization Board Chemical, Biological, Radiological and Nuclear (CBRN) Medical Working Group, held 1–3 February 2010 at NATO headquarters in Brussels, Belgium. Participants included each NATO member nation's representatives to the CBRN Medical Working Group and accompanying members of their delegations.[1] Exercise development, planning and execution were under the auspices of IDA Task CA-6-3079, CBRN Casualty Estimation Update of the Medical CBRN Defense Planning & Response Project, co-sponsored by the Joint Staff, Joint Requirements Office (JRO) for CBRN Defense, (J-8/JRO) and OTSG. This study documents IDA's work on the exercise.

The OTSG CBRN Medical Staff Officer serves as the U.S. Head of Delegation to the NATO CBRN Medical Working Group. This officer is responsible for coordinating the U.S. position on Alliance issues within the purview of the working group, and for overseeing the development of related standardization agreements for which the United States is the custodian. *AMedP-8(C)*, developed and recently completed by IDA, is such an agreement. The OTSG CBRN Medical Staff Officer requested that the CBRN Medical Working Group vote on whether or not to move forward with ratification of *AMedP-8(C)* at its February 2010 meeting, and believed that a tabletop exercise designed to walk through the *AMedP-8(C)*'s casualty estimation methodology would support a positive outcome. In addition, OTSG asked IDA to prepare the exercise in such a way that the national delegates could themselves conduct the exercise upon their return to their home countries, to propagate use of the methodology in *AMedP-8(C)* and in support of subsequent ratification processes by each nation.

Although the CBRN Medical Working Group voted to accept the U.S.-proposed Ratification Draft of *AMedP-8(C)* before the conduct of the exercise, the exercise was held as planned and received enthusiastic, positive feedback from the participants.

[1] A list of exercise attendees is provided in Appendix C.

Chapter 2 of this document describes the component parts of the exercise, how they were developed, and some of the thinking behind analytical decisions while planning for the exercise. Chapter 3 describes how the exercise was conducted, including some of the issues, questions and concerns that participants raised. Chapter 4 summarizes the results of the exercise. Appendix A provides the exercise scripts, worksheets and background materials, while Appendix B provides the casualty estimation outputs generated by the exercise participants.

2. Exercise Development

A. Concept

The purpose of the tabletop exercise "Dread Night" was to promote an understanding of the methodology prescribed in *Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN Casualties* (hereafter referred to as *AMedP-8(C))* among NATO member nations deciding whether to ratify the document as a standardization agreement. *The AMedP-8(C) NATO Planning Guide* describes a methodology for estimating casualties over time in a user-specified scenario involving a chemical, biological, radiological and nuclear (CBRN) attack. A casualty estimate is developed in three phases: calculation of dose, dosage or insult; estimation of human response; and summation and reporting. Each of these phases was explored during the course of the exercise.

Throughout the development of *AMedP-8(C),* reviewers routinely pointed to the complexity of the casualty estimation methodology it described as a potential barrier to its acceptance and use. As a result, the exercise was designed to step through the component parts of the methodology and demonstrate that its execution is, in fact, fairly straightforward. To that end, we, the IDA study team selected a very basic scenario and inputs, and structured the exercise materials to make the process as straightforward as possible.

For several years, the CBRN Medical Working Group has conducted a tabletop exercise as part of its annual meeting, to facilitate understanding of one or more current issues. In 2009, the exercise was designed by Norway and explored how biological agent detection and sample analysis could support decision-making and medical response. The scenario used in the 2009 exercise involved a covert anthrax attack against NATO forces deployed in and around Kabul International Airport in Afghanistan.

Exercise "Dread Night" used this same basic scenario, for several reasons. First, the participants would be familiar with the behavior of the agent, anthrax. Because *AMedP-8(C)* considers only the aerosol form of the agent and a single route of entry, inhalation, it is one of the simplest ways to become familiar with the methodology. While the selection of the agent was purely coincidental, it did support the objective of the exercise. Second, the 2009 exercise familiarized the participants with the prospective role of detection systems in mitigating casualties. Since the effects of detection are one of the factors considered within *AMedP-8(C),* this provided additional support for the objectives of the

exercise. Finally, given the recent expansion of NATO operations in Afghanistan, the currency of the scenario brought additional realism and interest to the exercise.

As in the 2009 exercise, the assigned role of the participants in "Dread Night" was that of the International Security Assistance Force (ISAF) senior medical officer taking part in a planning exercise prior to deployment to an Air Port of Disembarkation (APOD) in a theater of operations. The specific scenario information used in the exercise is described in the next section.

The United States was given a three-hour block of time on 3 February, 2010—the last day of the meeting—to conduct the exercise. The exercise structure and schedule are further described below, as are the preparations made by the IDA team and the U.S. delegation in advance of the exercise.

B. Scenario

The *AMedP-8(C)* methodology estimates both the number of expected casualties and fatalities and the time they will occur, as a function of the CBRN dose/dosage/insult received by individuals. For any scenario, dose/dosage/insult can be simply postulated, but it can also be calculated using the methodology described in *AMedP-8(C)*. The latter approach was the one taken in the exercise.

Calculation of dose/dosage/insult requires several inputs related to the scenario, including information on the tactical formation of units and the CBRN environment, specifically the amount of agent accumulated at the geospatial locations occupied by individuals over the course of the scenario.

As noted, the exercise scenario involved the covert use of anthrax against NATO forces located in and around Kabul International Airport in Afghanistan. We initially thought to generate a tactical laydown of forces using the actual configuration of the airport and of NATO units that might be deployed there. However, in consultation with the sponsors, we decided that this approach could add too much verisimilitude to the scenario and raise concerns over the security and classification of the exercise materials. In lieu of this, we chose to use the APOD tactical laydown developed by IDA for use in *AMedP-8(A), Volume II: Biological*, an earlier version of the document that provided tabular casualty estimates for specified scenarios. The APOD laydown presents Allied forces defending an airfield used as the entry point for troops, equipment, and supplies into the theater of operations, a mission very similar to the one in our Afghanistan scenario. In addition, this laydown had the advantages of being accepted by past incarnations of the CBRN Medical Working Group and of already being organized and structured in a manner that would support its use in the *AMedP-8(C)* methodology.

At IDA, this tactical laydown was maintained in two forms: 1) a spreadsheet that provided a list of personnel by location (expressed on an x, y grid measured in meters)

and by unit type or activity; and 2) an image file depicting personnel by type arrayed around the APOD physical structures, such as runways and control towers. Upon review, we discovered that these two forms did not match as well as they should have. Some of the units were shown at different locations than they should have been given their relationship to others on the x, y grid; others appeared to have been mislabeled. Guided by some of the original material used to derive the laydown, we were able to adjust the image so it aligned with the spreadsheet and to correct the labels. The updated image provided to exercise participants is shown in Figure 1.

The methodology used to develop earlier versions of *AMedP-8(C)* did not consider shielding from buildings and vehicles; hence the APOD tactical laydown did not initially include an assignment of building or vehicle type (if any) to each location. Using Table A-2 from *AMedP-8(C)* and experience gained in developing the illustrative examples provided in Annex B of *AMedP-8(C)*, we were able to assign building and vehicle types to APOD locations in a straightforward manner. This information was provided to the exercise participants for their use in developing a casualty estimate and is included in Appendix A of this document.

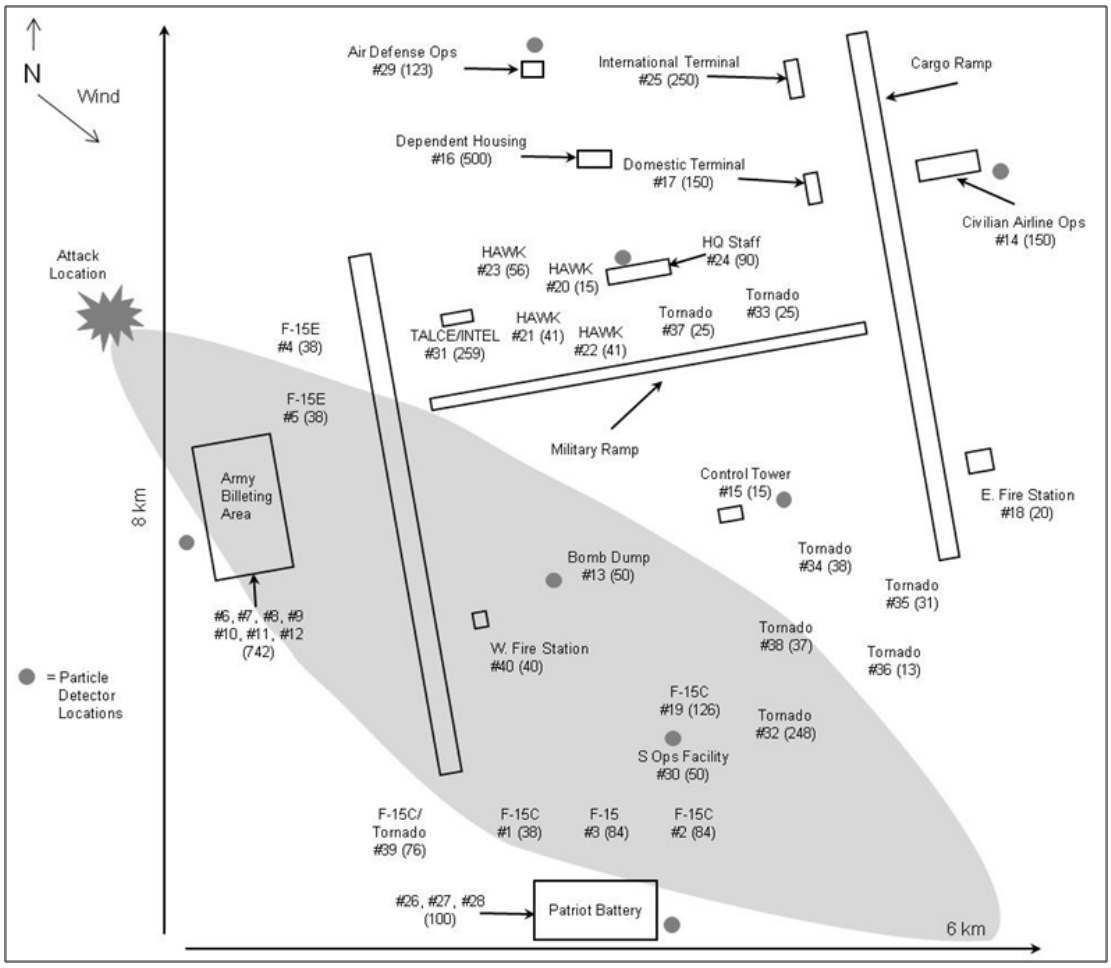

Figure 1. Air Port of Disembarkation Graphic

In addition to the tactical laydown of forces, the scenario information required includes a characterization of the CBRN environment resulting from the postulated attack. Typically this information is generated using a transport and dispersion model. We used the Vapor, Liquid, and Solid Tracking (VLSTRACK) computer model.[2] This model requires inputs on the type and quantity of agent considered, the means of delivery, the prevailing meteorological conditions, and the date and time of the attack.

For the exercise, we modeled a release of three kilograms of dry anthrax, disseminated via a stationary sprayer over a ten-minute period. The terrain was modeled as barren, and the sprayer altitude was set at two meters. The meteorological data used were those recorded at Kabul International Airport on 1 February 2009,[3] selected to be representative of the conditions that might be experienced on the anticipated date of our exercise. Since biological agent dissemination conditions are generally most favorable at night when ultraviolet light is absent, the attack was assumed to occur at 10:00 pm local time.

The first six hours of meteorological data used in the exercise scenario are shown in Table 1. It should be noted that the measurements were recorded at 20 minutes past the hour (these were rounded backwards for input into VLSTRACK) so that, for example, the 10:20 pm observations were input as the 10:00 pm observations. Moreover, we rolled the data over at the end of the day, so that the measurements recorded at 11:00 pm on 1 February 2009 were followed by those recorded at 12:00 am on 1 February 2009, versus those recorded at 12:00 am on 2 February 2009, as actually occurred. In practical terms this did not affect the output of the model since all accumulation of the agent at APOD locations occurred within the first hour after release of the agent.

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[2] For a description of the VLSTRACK model, see Timothy J. Bauer and Matthew G. Wolski, *Software User's Manual for the Vapor, Liquid, and Solid Tracking (VLSTRACK) Computer Model, Version 3.1*, NSWCDD/TR-01/83, Dahlgren, VA: Dahlgren Division, Naval Surface Warfare Center, April 2001.

[3] Reported by the Weather Underground Corporation, an online weather service, at www.wunderground.com.

Table 1. Meteorological Data Used to Model Anthrax Environment

Time	*Temp (°F)*	*Humidity (%)*	*Wind Direction*	*Wind Speed (mph)*	*Conditions*
10:20 pm	35.6	70	NW	5.8	Haze
11:20 pm	35.6	70	WNW	4.6	Haze
12:20 am	32.0	75	West	3.5	Haze
1:20 am	28.4	86	WNW	5.8	Mist
2:20 am	30.2	75	SW	2.3	Mist
3:20 am	30.2	75	Variable	2.3	Mist

Given that the prevailing winds at the start of the postulated attack were from the northwest, we chose an attack location on the northwest boundary of the APOD. Specifically, as shown in Figure 1, we selected a location that would expose personnel located in the billeting area of the base, and then spread further downwind.

The outputs from the VLSTRACK model were combined with the tactical laydown spreadsheet data using the IDA BioStrike model.[4] The output of the BioStrike model can be tailored to many purposes; in this case, we simply asked it to report the amount of agent accumulated at the x, y locations contained in the APOD troop laydown. Since BioStrike's outputs are reported for the total duration time, separate runs were conducted and truncated at one-minute intervals in order to track the accumulation of agent at various locations over time.

It should be noted that the Biostrike-calculated accumulated agent values used in the exercise were for an attack location we selected given the assumed meteorological conditions and the configuration of forces on the APOD. This attack location was not selected to maximize the resulting number of casualties.

Since VLSTRACK is a mass-based transport and dispersion model, it measures cumulative agent dosage in units of mass, in this case µg-min/m^3. The human response component part of the *AMedP-8(C)* methodology, on the other hand, requires that anthrax dose values be expressed in spores. Therefore, to accommodate the requirements in *AMedP-8(C)*, VLSTRACK outputs must be converted to spores. The number of spores per microgram of anthrax agent can vary widely based on how the agent is grown and processed. For the purposes of this exercise, we assumed that the number was similar to the one used in the now-defunct U.S. offensive biological warfare program.

[4] Mary Catherine Flythe, *BioStrike-3 User's Manual*, IDA Document D-2628, (Alexandria, VA: Institute for Defense Analyses, July 2001).

The shaded plume depicted in Figure 1 shows the APOD locations where anthrax accumulated during the postulated attack. The shading was added to the figure by hand, and is not a full representation of the outputs of VLSTRACK. As modeled, the plume was, in fact, significantly larger than it is shown, but it did not reach its greatest dimensions until after it had moved downwind of the APOD locations. Since the exercise only considered the effects on the APOD population, this artifice did not affect the outcome; however, it is likely that any population (military or civilian) in the area southeast of the base in the minutes and hours following the attack would be exposed to anthrax as well.

Finally, Figure 1 shows assigned locations for the notional particle detection systems present in the scenario. In our initial development of the exercise, the availability of a biological agent detection capability in the scenario was simply noted, and we did not make any assumptions about the number and location of detectors at the APOD. However, discussions with OTSG convinced us that the participants would be better able to visualize the scenario if these locations were defined. Hence we developed a detector deployment scheme—shown in Figure 1—with eight detectors located at a combination of interior and perimeter sites and associated each with a permanently manned structure. We also sought to assign those locations so that agent would pass over the first detector location and generate an alarm fifteen minutes after the start of the attack, as described in the scenario.

C. Structure and Schedule

From the start, we planned to conduct the exercise in three sequential parts, or sessions, paralleling the three phases in the development of a casualty estimate in *AMedP-8(C)*: calculation of dose, dosage or insult; estimation of human response; and summation and reporting. For each session, we developed a set of worksheets that would walk the participants through the set of calculations used in the associated phase of casualty estimation, and provided the supporting materials they would need to make decisions on required inputs.

We further planned to divide the exercise participants into three groups, each of which would be assigned different planning assumptions in the development of their CBRN casualty estimates. The variation in these planning assumptions was designed to highlight the sensitivity of the resulting casualty estimate to various factors, specifically physical and medical protection. One group would represent the worst case, assuming that APOD forces were unvaccinated against anthrax and did not have any biological detection capability. A second group would also be unvaccinated, but would have biological detectors of various types and would implement physical protection as soon as a particle detector alarmed. A third group would both be vaccinated and have a biological

detection capability, but would wait to implement physical protection until the particle detector alarm had been confirmed through subsequent sample analysis.

Finally, in order to compare the results among the groups, we decided that each group should develop a casualty estimate for one specified icon—or group of individuals sharing a common location—in the scenario, and then be given the freedom to do so for additional icons of choice as time permitted. We decided that Icon 10, representing 98 people in billeting at the time of attack, would be most appropriate for this purpose since these individuals were exposed to relatively large quantities of agent, both before and after the postulated time at which particle detectors would alarm and physical protection would be implemented. At the same time, the number of individuals was large enough that even at very high vaccine efficacy rates, some individuals would be expected to become ill with anthrax and could be tracked through the human response component of the methodology. In short, we expected that the selection of this icon would generate interesting results for all three groups, and that these results would vary significantly, thus highlighting the sensitivity of results to the factors we varied in establishing each group's planning assumptions.

Although we were allotted three hours for the exercise, we felt that, in practice, the amount of time spent in working groups would be about 90 minutes. In addition, we wanted to be able to allow time for discussion. We planned to begin the exercise with a short overview—given by the U.S. Head of Delegation—of the objectives and purpose of the exercise and of the scenario for which the groups would be generating a casualty estimate. This would be followed by the three phases of the exercise, separated by a short period of group reporting, discussion and/or a break. The exercise would then conclude with a short period for any additional comments and questions.

D. Preparation

The United States held a Position Meeting in early January 2010 to review and prepare a consensus position on the issues at the upcoming CBRN Medical Working Group agenda. As part of that Position Meeting, held at IDA, we were able to conduct a dry run of the planned exercise, using draft worksheets and other exercise support materials. In addition, prior to the U.S. Position Meeting, we conducted a preliminary dry run with several of our IDA colleagues who were familiar with *AMedP-8(C)* and with our CBRN casualty estimation methodology.

Both of these dry runs proved extremely useful, resulting in several modifications to the exercise and helping to simplify and clarify the support materials. These included the addition of detector locations to our scenario graphics, the inclusion of a "hangar" structure to house aircraft located on the southern side of the APOD runways, and the portrayal of environment information in five-minute vs. one-minute increments.

The dry runs also reinforced our view that electronic calculation tools would be needed to support the exercise. Each working group was assigned an IDA project team member to act as a facilitator, and each had a spreadsheet that automatically generated the output values and tables for all the icons that the groups were tasked with developing by hand for a single icon. In addition, these spreadsheets could be used to minimize some of the simple but repetitive math required in the exercise worksheets.

Each participant in the exercise was given hard copies of the materials provided in Appendix A. These materials were bound in a folder, with tabs demarcating each section. In addition, OTSG directed us to include additional sets of worksheets in each folder, and to provide each Head of Delegation with an extra folder that they could use to replicate the exercise within their Nation.

3. Description of the Exercise

Exercise "Dread Night" was conducted on the morning of 3 February, 2010, at the NATO headquarters building in Brussels, Belgium. The participants were delegates to the CBRN Medical Working Group attending the annual meeting. Following introductory remarks by the U.S. Head of Delegation, the participants were divided into three working groups. Each was given a different set of planning assumptions for use in the exercise.

Group 1 was designated as the "No Detection/No Vaccination" group; it did not have biological agent detectors, and was instructed to ignore considerations of physical protection and vaccination in its calculations. Group 2 was designated as the "Limited Protection" group; this group was instructed to assume that particle detectors would alarm 15 minutes after the start of the attack, and that physical protection would be implemented immediately thereafter. The group was also told to ignore any consideration of vaccination in its calculations. Finally, Group 3 was designated as the "With Vaccination" group. This group was instructed to consider vaccination in its calculations, and to assume that physical protection would not be implemented until its rapid biological sampling analysis capability generated a positive reading for anthrax, 60 minutes after the start of the attack.

All of the members of each national delegation were assigned to a single working group, with the exception of the members of the U.S. delegation, who were divided among the groups to act as leaders and facilitators. In addition, each group was assigned one member of the IDA team to answer questions and provide electronic calculation support.

A. Session 1: Calculation of Adjusted Anthrax Dose

During Session 1, the groups were asked to: 1) define an activity level and associated breathing rate; 2) determine the degree of shielding from attack, if any, offered by structures and vehicles; and 3) determine the type of physical protection available, the degree to which it mitigated the attack, and the time at which it was implemented, if the group's planning assumptions included the use of physical protection. Although giving the groups responsibility for selecting these factors might have resulted in outputs that were more difficult to compare than if the factors were simply assigned; medical planners would be required to select these factors in the execution of the methodology, so we felt that doing so was an important part of the exercise. The groups then used the results of their decision to calculate the dose to individuals in their considered icon or icons.

Group 1 did not consider either physical or medical protection, so their casualty estimate represented the worst case. During Session 1, the group was able to calculate the dose for Icon 10, and decided to calculate the dose to Icon 5, a group of flight-line aircraft with 38 individuals readying them for take-off, as well. The group decided to consider the billeted population in Icon 10 as engaged in light activity and the flight-line population in Icon 5 as engaged in moderate activity. Determination of the duration of exposure for Icon 10 for use in calculating the icon's shielding factor was straightforward from the provided dosage-over-time table, and not applicable for Icon 5, whose population was in the open and unshielded. Since Group 1's planning assumptions stated that protection was not available, the group did not consider it. Group 1, with no physical protection considered, estimated a total external dosage of 87,359,940 spore-minutes/m^3 and a total dose of 103,378 spores for Icon 10 and a total external dosage of 77,780,100 spore-minutes/m^3 and a total dose of 2,333,403 spores for Icon 5.

The limited protection group (Group 2) first worked through Icon 10, the billeting population icon common to all groups, and then proceeded to calculate exposure to Icon 32, a group of 248 individuals maintaining Tornados in a hangar in the southeast corner of the APOD. Calculating the adjusted dose in Session 1 proved to be the most difficult section for participants in Group 2 to work through. Although they were familiar with breathing rates, shielding factors, and protection factors, they were not accustomed to determining the values for each of these parameters, and considerable thought was required to justify each one. There was considerable discussions regarding how to determine the activity level of individuals in their barracks at 10:00 pm: Would they be at rest because they were in their bunks or would they still be moving around and hence be classified as performing light activity?

The shielding factor calculation in *AMedP-8(C)*, which is a function of air exchange rate, duration of cloud exposure at the building location, and building occupancy time, was a new concept for most participants. In particular, determining the duration of exposure posed a challenge, although it is expected that if the cumulative dosage values were given in one-minute increments (as they may be from a dispersal model), there would have been less confusion. Once they understood it, however, they were impressed with the complexity and flexibility of the model.

Group 2 differed from the others in that physical protection was implemented early enough that it could reduce the amount of agent inhaled by individuals at the various icons. Once participants conceptualized how this parameter was implemented in the methodology, they seemed to have no problem applying it. Confusion arose, however, when the results for the two icons were compared. Due to its proximity to the attack location, individuals at Icon 10 received most of their exposure prior to implementing physical protection at 15 minutes. In contrast, individuals at Icon 32 were farther away from the point of attack, so when they initiated physical protection at 15 minutes, the

cloud had not yet arrived and they were protected for the entire exposure. As a result, those at Icon 10 received a total dose two orders of magnitude greater than those at Icon 32. Nevertheless, the misunderstanding resulted from those at Icon 32 having received a higher dose than those at Icon 10 *after physical protection was initiated*. Some participants felt that since individuals at Icon 32 donned protection before the cloud arrived, the contribution to the dose received after protection was initiated should have been less than for Icon 10. In reality, the comparison should have been made between the total doses, not the post-protection portion of the calculation because those at Icon 32 had to protect against 50% more spores while masked than did those at Icon 10. Group 2 estimated a total external dosage of 87,359,940 spore-minutes/m^3 (68,154,360 spore-minutes/m^3 before physical protection and 19,205,580 spore-minutes/m^3 after physical protection was implemented) resulting in a total dose of 40,332 spores for Icon 10 (40,325 spores before physical protection and 7 spores after physical protection). For Icon 32, Group 2 estimated a total external dosage of 29,356,620 spore-minutes/m^3 (all after physical protection was implemented) and a total dose of 167 spores.

Group 3 did not consider physical protection, but was regarded as vaccinated, and therefore assumed to have medical protection. During Session 1, the group was able to readily calculate the dose for Icon 10, and decided to calculate the dose to Icon 6 as well, a group of personnel also in a billeting facility, but exposed to higher concentrations earlier and provided with collective protection which was always on. The group decided to consider both billeted populations as engaged in light activity. The calculation of the total dose illustrated the differential in having no individual protection versus having full collective protection: Icon 10, with no physical protection and a total external dosage of 87,359,940 spore-minutes/m^3 had a total dose of 103,378 spores; Icon 6, with collective protection and a total external dosage of 367,791,600 spore-minutes/m^3 had a total dose of 145 spores.

B. Session 2: Calculation of Anthrax Human Response

During Session 2, the groups were asked to calculate the expected number of ill in their considered icons, given their calculated dose and the infectivity equation provided. If the group's planning assumptions included the use of medical protection, the group determined the percentage of individuals who had medical protection and its associated efficacy. During this session, the groups were also asked to select the minimum injury severity level at which individuals would be expected to enter the medical system; which then became the criterion for defining a casualty. Finally, given the expected number of ill and the selected casualty criterion, the groups were asked to use a set of look-up tables to determine the time-phasing of casualties and fatalities at their considered icons.

Group 1 was able to readily calculate the number of expected ill at both Icon 10 and Icon 5, using the infectivity equation. Because the planning assumptions stated that the

population had not been medically protected, the group did not consider it. Group 1 agreed to use Severity Level 1 as a casualty criterion; although this decision was a matter of some debate in other groups and in prior exercises, it was not extensively debated within this Group 1. Although the group's planning assumptions placed a high priority on execution of the mission, the group contended that treatment needed to be initiated as soon as possible for individuals symptomatic with anthrax. Group 1 estimated that there would be 80.9 persons ill (of 98 persons) at Icon 10, and 38 persons ill (of 38) at Icon 5.

Group 2 held an interesting discussion regarding the choice of severity level used as the criterion for determining casualty status. Participants recognized and discussed the dual-purposed nature of the casualty estimate resulting from the *AMedP-8(C)* methodology as a tool for both medical and operational planners. They quickly understood the implications of choosing a lower criterion for this scenario: casualties would present to the medical system sooner and with less severe injuries than if a higher criterion were chosen. At the same time, these soldiers would be unavailable for combat sooner than if they waited until worse symptoms developed. Thus, there is a trade-off between maintaining operational capability and maximizing the time medical personnel have to treat casualties early in the progression of injury. After this discussion, Group 2 agreed that this decision was highly dependent on national medical treatment policies, which varied within the group; for the purposes of progressing through the exercise, Group 2 chose Severity Level 1 as the casualty criterion. Group 2 estimated that there would be 48.4 persons ill (of 98 persons) at Icon 10, and 0.7 persons ill (of 248) at Icon 32.

During Session 2, Group 3 eventually agreed on using Severity Level 2 as a casualty criterion; although this decision was a matter of some debate. Since Group 3 considered medical protection, the benefits of the use of vaccination were clear: the estimate was that only four people became ill at Icon 10, and none at Icon 6.

C. Session 3: Development of Casualty Estimates

During Session 3, the groups were provided with summary tables of the results for all icons in the scenario and shown how to summarize the information in the tables to produce a casualty estimate in the format required by NATO doctrine. The groups discussed how their various planning assumptions and choices made during the course of the exercise influenced the final results, and provided feedback and lessons learned on the exercise as a whole.

Session 3 did not require any active decision-making by the group. They readily grasped how the outputs from Session 2 produced the final casualty estimate and did not have many questions. The third session was an exercise in reporting and participants had no trouble picking this up.

4. Summary Results

A. Working Group Outputs

After each session, the IDA facilitators applied each group's choices regarding exposure, human response, and casualty status to the remaining icons in the scenario. The final casualty estimates generated by each of the three groups are provided in Tables 2 through 4 and represent estimates for all icons in the scenario. Although comparison and review of these outputs was beyond the scope of the exercise, they are provided here for completeness. The intermediate tables produced by the working groups in the course of generating these estimates are in Appendix B.

Table 2. Casualty Estimate Generated by Group 1: No Protection/No Vaccination

Estimated Number of Anthrax Casualties Per Day									
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 15	Day 30
Prompt Fatalities (KIA)	0	0	0	0	0	0	0	0	0
Delayed Fatalities (DOW)	0	0	12	60	133	178	172	396	12
Total Fatalities	0	0	12	60	133	178	172	396	12
Mild Anthrax Casualties (Severity Level 1)	0	0	0	0	0	0	0	0	0
Moderate Anthrax Casualties (Severity Level 2)	128	342	350	111	24	5	1	2	0
Severe Anthrax Casualties (Severity Level 3)	0	0	0	0	0	0	0	0	0
Very Severe Anthrax Casualties (Severity Level 4)	0	0	0	0	0	0	0	0	0
Total Casualties (WIA(1))	128	342	350	111	24	5	1	2	0

Table 3. Casualty Estimate Generated by Group 2: Limited Protection[5]

Estimated Number of Anthrax Casualties Per Day									
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 15	Day 30
Prompt Fatalities (KIA)	0	0	0	0	0	0	0	0	0
Delayed Fatalities (DOW)	0	0	3	12	28	44	53	200	10
Total Fatalities	0	0	3	12	28	44	53	200	10
Mild Anthrax Casualties (Severity Level 1)	0	0	0	0	0	0	0	0	0
Moderate Anthrax Casualties (Severity Level 2)	29	58	95	74	45	24	12	12	0
Severe Anthrax Casualties (Severity Level 3)	0	0	0	0	0	0	0	0	0
Very Severe Anthrax Casualties (Severity Level 4)	0	0	0	0	0	0	0	0	0
Total Casualties (WIA(1))	29	58	95	74	45	24	12	12	0

Table 4. Casualty Estimate Generated by Group 3: With Vaccination

Estimated Number of Anthrax Casualties Per Day									
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 15	Day 30
Prompt Fatalities (KIA)	0	0	0	0	0	0	0	0	0
Delayed Fatalities (DOW)	0	0	2	8	18	25	24	54	2
Total Fatalities	0	0	2	8	18	25	24	54	2
Mild Anthrax Casualties (Severity Level 1)	0	0	0	0	0	0	0	0	0
Moderate Anthrax Casualties (Severity Level 2)	19	47	48	15	3	1	0	0	0
Severe Anthrax Casualties (Severity Level 3)	0	0	0	0	0	0	0	0	0
Very Severe Anthrax Casualties (Severity Level 4)	0	0	0	0	0	0	0	0	0
Total Casualties (WIA(2))	19	47	48	15	3	1	0	0	0

These casualty estimates, as expected, show a large difference between the worst case, Group 1, and those with physical or medical protection. Group 1 estimated a total of 963 eventual casualties, while Group 2 estimate 349 casualties and Group 3 estimated 163. Very clearly the use of either form of protection can greatly mitigate the number of casualties and fatalities that would result from an anthrax attack. Interestingly, the estimated casualties for Group 3 were significantly smaller than those estimated for Group 2. This occurred even though the assumed vaccine efficacy factor was 90%

[5] Note that the number of fatalities estimated by Group 2 is one less than its estimated number of casualties. Although the AMedP-8(C) anthrax human response model considers the disease 100% fatal, the model is also an expected value model that considers response for fractions of people, which are then summed and portrayed in integer form at the end of the calculation. Thus it is possible for rounding to affect the final output. In addition, while the vast majority of individuals would be expected to die within 30 days, there is a non-zero probability that a tiny fraction would live longer, particularly at very low doses where their time to onset would be delayed. In the case of Group 2's estimates, both of these factors explain the disparity: to four decimal places, the number of expected casualties is 349.5005 (rounded to 350 in Table 3), while the number of expected fatalities within 30 days of the attack is 349.4389 (rounded to 349 in Table 3). The number of expected fatalities after 30 days is .0616, a number sufficiently large in this case to affect rounding.

(meaning 90% of vaccinated individuals were fully protected), while the protection factors for individual and collective protection were 1667 and 3000, respectively (meaning that individuals would inhale only 1/1667 and 1/3000 of what they otherwise would. In theory, physical protection should have conferred greater protection and resulted in fewer casualties than the vaccine. However, because of the 15-minute delay between the start of the attack and the implementation of physical protection, many individuals were completely unprotected during that time and their resulting doses quite high. This highlights the value of rapid implementation of physical protection.

B. Concluding Remarks

Exercise "Dread Night" provided a constructive learning opportunity for its participants. Members of the U.S. delegation who participated in both the dry run and the actual exercise came away with a better understanding of the *AMedP-8(C)* casualty estimation methodology. All of the comments by the national delegates immediately following the exercise were very positive and focused on how their comprehension of the document and the casualty estimation process had been improved by the experience.

Nonetheless, it is unknown at this time whether the exercise materials provided to the Nations have been used in other countries, or whether they ultimately will be used to support ratification of *AMedP-8(C).*

Appendix A.
Exercise Materials

The materials provided to the exercise participants are provided in this section. Each participant was given a folder with tabs separating each subsection. While the following pages have not been tabbed, the page and section breaks have been retained so that the reader can exercise the methodology described in *Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties* (*AMedP-8(C)*). The headers inserted on the worksheets have also been retained, to help identify which component part of the methodology they are supporting. The unique footers for each worksheet, however, have been replaced by page numbers consistent with the formatting requirements of this document.

A. Background and Purpose

1. Purpose

The purpose of the tabletop exercise (TTX) "Dread Night" is to promote understanding of the process of generating casualty estimates using *Allied Medical Publication 8 (C): NATO Planning Guide for the Estimation of CBRN Casualties* (*AMedP-8(C)*).

2. Role

The role of the target audience in Exercise "Dread Night" is that of the International Security Assistance Force (ISAF) senior medical officer taking part in a planning exercise prior to deployment to a theater of operations.

3. AMedP-8(C) Background

AMedP-8(C) provides a methodology for estimating casualties that occur over time following a chemical, biological, radiological and nuclear (CBRN) attack. As shown in Figure A-1, development of a casualty estimate comprises three phases: calculation of dose, dosage or insult; estimation of human response; and summation and reporting.

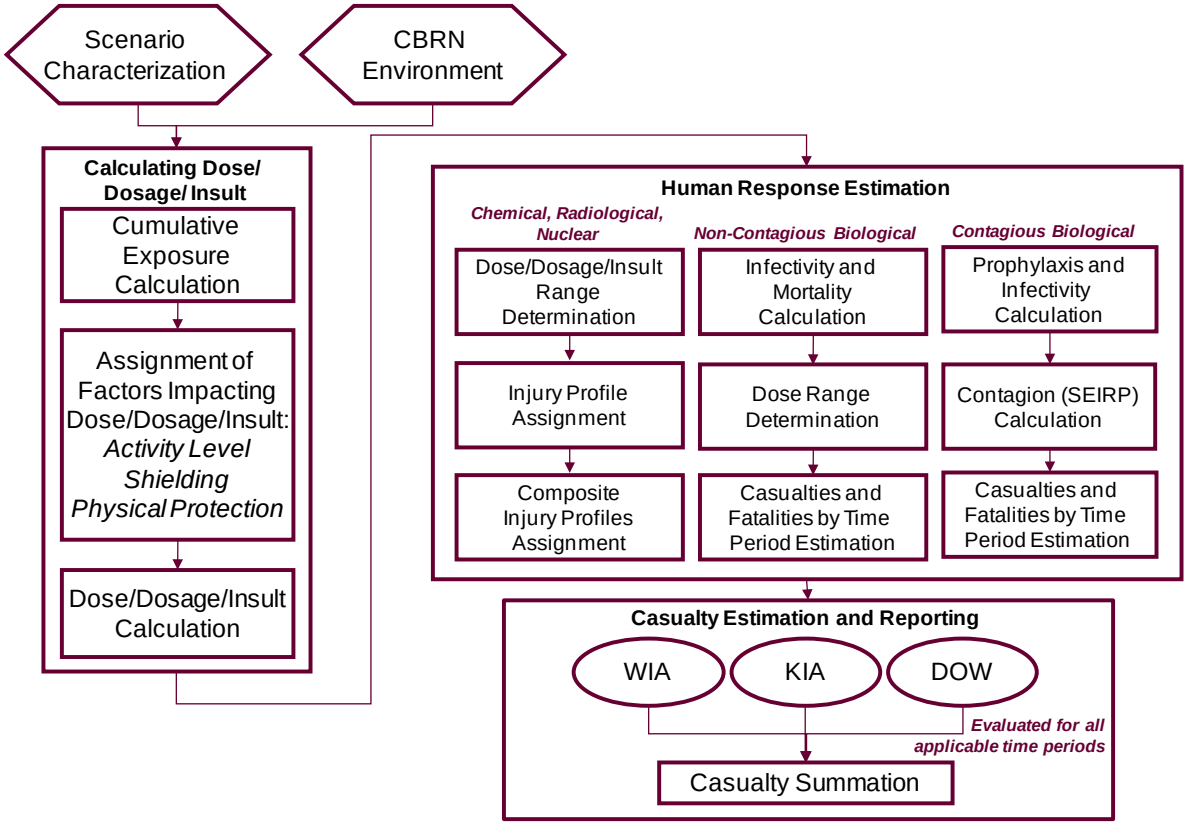

Figure A-1. *AMedP-8(C)* Methodology Overview

The fundamental concept of the *AMedP-8(C)* methodology is that an individual will be considered a casualty at the moment in time when his symptoms equal or exceed a user-specified level of severity. While the nature of the injury and the time of onset depend on the specific agent or effect, the *AMedP-8(C)* methodology uses five standard severity levels to describe the progression of injury for all CBRN agents and effects. Table A-3 at Tab 4 defines these five severity levels.

Users of the *AMedP-8(C)* methodology must establish a casualty criterion, defined as the injury severity level that would result in the individual becoming a loss to the unit. A casualty criterion defining someone as a casualty at Severity Level 1 (“Mild”) or greater will be designated as Wounded in Action (WIA)(1). A casualty criterion defining someone as a casualty at Severity Level 2 (“Moderate”) or greater will be designated as WIA(2). Finally, a casualty criterion defining someone as a casualty at Severity Level 3 (“Severe”) or greater will be designated as WIA(3). Since “Severe” symptoms are defined as those which preclude an individual’s ability to conduct the assigned mission, a casualty criterion set above WIA(3) is not defined, and a designation of WIA(4) is never assigned.

B. Exercise "Dread Night" Schedule and Structure

Exercise "Dread Night" is divided into three sessions, each of which corresponds to one component of the *AMedP-8(C)* casualty estimation process. Participants will divide into three working groups, each of which will be given different planning assumptions regarding the use of physical and medical protection.

1. Schedule

0900 – 0915 Introduction

The TTX purpose and structure will be described and the scenario introduced. Participants will divide into three work groups.

0915 – 1000 Session 1: Calculation of Adjusted Anthrax Dose

Using provided worksheets and tables from Annex A of *AMedP-8(C)*, participants will develop estimates of anthrax doses to personnel at one or more scenario icons, given assumptions about activity level, detection, and physical protection.

1000 – 1015 Group Reporting and Feedback

1015 – 1030 Break

1030 – 1100 Session 2: Calculation of Anthrax Human Response

Using provided worksheets and tables from Annex A of *AMedP-8(C)*, participants will develop estimates of anthrax human response over time at one or more scenario icons.

1100 – 1115 Group Reporting and Feedback

1115 – 1145 Session 3: Development of Casualty Estimates

Participants will summarize the information generated in Session 2 in the form of casualty estimate tables.

1145 – 1200 Discussion and Wrap-up

2. Working Groups

Participants in Exercise "Dread Night" will divide into three groups, each of which will use different planning assumptions in the development of their CBRN casualty estimates.

Group 1: No Detection, No Vaccination

Commander's guidance: This unit's priority is on its tactical mission, the movement of aircraft in and out of the Air Port of Disembarkation (APOD).

Scenario conditions:

- The unit does not have biological agent detectors
- Troops have not been vaccinated against anthrax
- Troops located within vehicles or structures when the agent cloud passes over remain there for the duration of cloud transit.

Group 2: Mask on Particulate Detector Alarm, No Vaccination

Commander's guidance: While recognizing the urgency of the mission, the CBRN threat is of great concern. Because unit personnel have chosen not to be vaccinated against anthrax, the unit places a heavy emphasis on detection of CBRN hazards and aggressive use of physical protection to limit exposure to those hazards.

Scenario conditions:

- The unit has aerosol particulate detectors, which alarm 15 minutes after the attack begins
- The unit has a rapid biological sample analysis capability, which generates a positive reading for anthrax 60 minutes after the attack begins
- Troops have not been vaccinated against anthrax
- Concerned about the CBRN threat and the lack of associated medical protection, the unit has adopted a policy of implementing physical protection when aerosol particulate detectors alarm
- Troops located within vehicles or structures when the agent cloud passes over remain there for the duration of cloud transit.

Group 3: Mask on Positive Sample Analysis, With Vaccination

Commander's guidance: While recognizing the urgency of the mission, the CBRN threat is of great concern. Because unit personnel have been vaccinated against anthrax, the unit will delay implementation of physical protection—with its associated impact on mission accomplishment—until a positive result has been observed from the unit's CBRN sample analysis capability.

Scenario conditions:

- The unit has aerosol particulate detectors, which alarm 15 minutes after the attack begins
- The unit has a rapid biological sample analysis capability, which generates a positive reading for anthrax 60 minutes after the attack begins
- Troops have been vaccinated against anthrax
- Troops located within vehicles or structures when the agent cloud passes over remain there for the duration of cloud transit.

C. Exercise "Dread Night" Planning Scenario

1. Scenario Description

NATO ISAF forces are deployed at an Air Port of Disembarkation (APOD). The notional APOD complex consists of an airfield supporting Air Force, Marine and Special Operations Command (SOCOM) air combat operations, as well as serving as a port of disembarkation for forces entering the region. Air Forces and Special Operations Forces have been deployed to the APOD area. In addition, several key headquarters facilities will be located here. The APOD covers an area of 8 kilometers by 6 kilometers in size. Total strength of all military units at this location is 3,593 military personnel.

CBRN has not been encountered so far in the campaign, but the APOD is considered open to both chemical and biological attack.

For planning purposes, a scenario is posited such that on the night of February 1st, opposing forces equipped with a stationary sprayer release a small quantity of anthrax just outside the northwest perimeter of the APOD, with the intention of exposing personnel in the barracks area. Meteorological conditions are favorable for the dissemination of aerosolized biological agent across the facility. Winds are light and variable, and coming from the rugged mountainous area northwest of the APOD.

The position of forces and particle detectors on the APOD is shown in Figure A-2. The figure also shows the hazard area associated with the anthrax release. To maximize the probability of detecting high levels of particulates, the detectors are located at both perimeter and interior locations that are evenly distributed across the APOD and collocated with fixed, continually manned structures, so that regular monitoring can be readily accomplished.

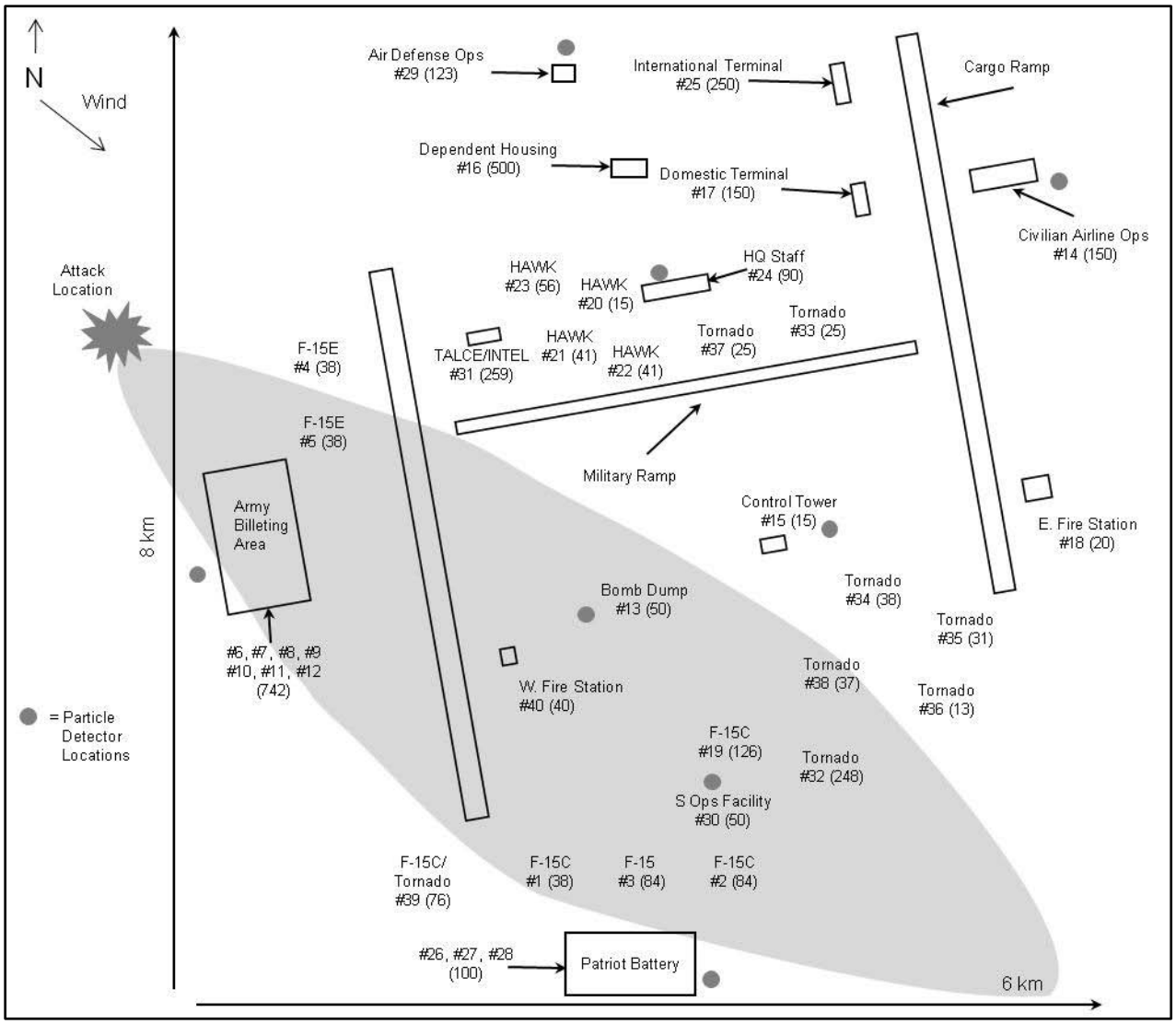

Figure A-2. ISAF Air Port of Disembarkation

2. Planning Scenario Force List

Table A-1. APOD Forces by Icon

Icon	Descriptor	X	Y	Troops	Building Type
1	12 F-15C	4.3888	1.942	38	Hangar
2	12 F-15C	5.3032	1.942	84	Hangar
3	12 F-15C	4.846	1.942	84	Hangar
4	12 F-15E	2.56	5.6	38	In the Open
5	12 F-15E	2.56	5.142	38	In the Open
6	Billeting Population	2.1028	5.142	48	Barracks
7	Billeting Population	2.1028	4.685	98	Barracks
8	Billeting Population	2.1028	4.228	68	Barracks
9	Billeting Population	3.0172	4.685	98	Barracks
10	Billeting Population	3.0172	4.228	98	Barracks
11	Billeting Population	2.56	4.685	166	Barracks
12	Billeting Population	2.56	4.228	166	Barracks
13	Bomb Dump	4.846	4.228	50	In the Open
14	Civil Airlines Opns	7.132	6.971	150	Administrative Bldg
15	Control Tower	5.7604	4.685	15	Work Bldg
16	Dependent housing	5.3032	6.971	500	Barracks
17	Domestic Terminal	5.7604	6.971	150	Administrative Bldg
18	E. Fire Station	7.132	5.142	20	Work Bldg
19	F-15C	5.3032	2.856	126	Hangar
20	HAWK	4.3888	6.057	15	In the Open
21	HAWK	3.9316	5.6	41	In the Open
22	HAWK	4.3888	5.6	41	In the Open
23	HAWK	3.9316	6.514	56	In the Open
24	Hq. Staff	4.846	6.514	90	Administrative Bldg
25	International Terminal	5.7604	7.428	250	Administrative Bldg
26	Patriot Battery	4.846	0.57	25	Van
27	Patriot Battery	5.3032	0.57	25	Van
28	Patriot Battery	4.846	1.028	50	Van
29	Host Nation Air Defense Operations	3.9316	7.886	123	Van
30	S. Ops. Facility	5.3032	2.399	50	Work Bldg
31	TALCE,OPS/INTEL	3.4744	5.6	259	Administrative Bldg
32	TORNADO	5.7604	2.856	248	Hangar
33	TORNADO	5.3032	6.057	25	In the Open
34	TORNADO	6.2176	4.228	38	Hangar
35	TORNADO	6.6748	4.228	31	Hangar
36	TORNADO	6.6748	3.771	13	Hangar
37	TORNADO	4.846	6.057	25	In the Open
38	TORNADO	5.7604	3.771	37	Hangar
39	TORNADO and F-15C	3.4744	1.942	76	Hangar
40	W. Fire Station	3.4744	3.771	40	Work Bldg

3. Scenario Environment by Icon

Table A-2a. Cumulative Dosage Min 0 through Min 40

Icon	Total Dosage (spore-min/m^3)	Min 0	Min 5	Min 10	Min 15	Min 20	Min 25	Min 30	Min 35	Min 40
1	267	0	0	0	0	173	266	267	267	267
2	6,999,138	0	0	0	1	2,001,546	6,131,832	6,979,044	6,999,138	6,999,138
3	218,056	0	0	0	7	104,509	209,416	218,056	218,056	218,056
5	77,780,100	0	2,223	7,735,986	43,874,280	77,540,400	77,780,100	77,780,100	77,780,100	77,780,100
6	367,791,600	0	27,706,260	223,696,200	356,622,600	367,791,600	367,791,600	367,791,600	367,791,600	367,791,600
7	100,207	0	102	74,406	99,484	100,207	100,207	100,207	100,207	100,207
9	138,057,000	0	0	9,110,742	60,978,660	129,876,600	138,057,000	138,057,000	138,057,000	138,057,000
10	87,359,940	0	0	14,629,860	68,154,360	85,644,300	87,359,940	87,359,940	87,359,940	87,359,940
11	153,734,400	0	43,828	58,972,320	135,802,800	153,479,400	153,734,400	153,734,400	153,734,400	153,734,400
12	345,933	0	0	123,400	332,387	345,474	345,933	345,933	345,933	345,933
13	514	0	0	0	0	3	195	514	514	514
19	101,457,360	0	0	0	352	10,337,700	52,110,780	100,433,280	101,457,360	101,457,360
30	76,533,660	0	0	0	662	17,338,980	55,958,220	75,660,540	76,533,660	76,533,660
32	29,356,620	0	0	0	0	514,967	6,443,544	24,855,360	29,320,920	29,356,620
38	928	0	0	0	0	0	39	634	923	928
40	49,668,900	0	0	2,363,238	30,437,820	46,657,860	49,661,760	49,668,900	49,668,900	49,668,900

Table A-2b. Cumulative Dosage Min 45 through Min 60

Icon	Total Dosage (spore-min/m^3)	Min 45	Min 50	Min 55	Min 60
1	267	267	267	267	267
2	6,999,138	6,999,138	6,999,138	6,999,138	6,999,138
3	218,056	218,056	218,056	218,056	218,056
5	77,780,100	77,780,100	77,780,100	77,780,100	77,780,100
6	367,791,600	367,791,600	367,791,600	367,791,600	367,791,600
7	100,207	100,207	100,207	100,207	100,207
9	138,057,000	138,057,000	138,057,000	138,057,000	138,057,000
10	87,359,940	87,359,940	87,359,940	87,359,940	87,359,940
11	153,734,400	153,734,400	153,734,400	153,734,400	153,734,400
12	345,933	345,933	345,933	345,933	345,933
13	514	514	514	514	514
19	101,457,360	101,457,360	101,457,360	101,457,360	101,457,360
30	76,533,660	76,533,660	76,533,660	76,533,660	76,533,660
32	29,356,620	29,356,620	29,356,620	29,356,620	29,356,620
38	928	928	928	928	928
40	49,668,900	49,668,900	49,668,900	49,668,900	49,668,900

D. Tables Excerpted From AMedP-8(C) For Use in Exercise "Dread Night"

Table A-3. Injury Severity Definitions *(AMedP-8(C)* Table C-1)

	Degrees	Description
0	N.O.E.	Although exposure to an agent or effect may have occurred, no observable injury (as would be indicated by manifested symptoms) has developed.
1	Mild	Injury manifesting symptoms (and signs for biological agents) of such severity that individuals can care for themselves or be helped by untrained personnel; condition may not impact ability to conduct the assigned mission.
2	Moderate	Injury manifesting symptoms (and signs for biological agents) of such severity that medical care may be required; general condition permits treatment as outpatient and some continuing care and relief of pain may be required before definitive care is given; condition may be expected to interrupt or preclude ability to conduct the assigned mission.
3	Severe	Injury manifesting symptoms (and signs for biological agents) of such severity that there is cause for immediate concern, but there is no imminent danger to life; individual is acutely ill and likely requires hospital care. Indicators are questionable —condition may or may not reverse without medical intervention; individual is unable to conduct the assigned mission due to severity of injury.
4	Very Severe	Injury manifesting symptoms (and signs for biological agents) of such severity that life is imminently endangered. Indicators are unfavorable —condition may or may not reverse even with medical intervention; prognosis is death without medical intervention; individual is unable to conduct the assigned mission and is not expected to return to the mission due to severity of injury.

Table A-4. Chemical and Biological Exposure Factors (*AMedP-8(C)* Table A-1)

Agent Type	Activity Level	Exposure Factor ($EF_{n,t}$)
Chemical Vapor	At Rest	0.5
	Light	1
	Moderate	2
	Heavy	5
Chemical Liquid	N/A	1
Biological Agent	At Rest	0.0075 (m^3/min)
	Light	0.0150 (m^3/min)
	Moderate	0.0300 (m^3/min)
	Heavy	0.0750 (m^3/min)

Table A-5. Calculation of Ventilation Shielding Factors for Vehicles and Shelters (*AMedP-8(C)* Table A-2)

$$SF_{vent,n,t} = \frac{AER_n * Duration_n}{AER_n * Duration_n + e^{(-AER_n * Occupancy_n)} - e^{AER_n * (Duration_n - Occupancy_n)}}$$

Vehicle/Shelter Ventilation Class	Examples	Air Exchange Rate (AER_n) (ACH)
Residential Building – Closed Windows	Barracks	0.5
Nonresidential Building – Closed Windows	Administrative, Control and Work Buildings	1.25
Residential Building – Open Windows	Hangar	6
Stationary Vehicle – Open Windows, No Ventilation	CBPS, Tent, TOC	13.3
Stationary Vehicle – Closed Windows, Fan on Recirculation	155 mm SP, 5-ton Van, Recovery	20
Moving Vehicle – Closed Windows	4.2 MTR, ACE, CHAPP, M106 A2 4.2, M113	36
Stationary Vehicle – Open Windows, Fan on Fresh Air	Truck/Van	40
In the Open	Dismounted, Foxhole	N/A

Table A-6. Physical Protection Factors (*AMedP-8(C)* Table A-3)

Protection Type	Protection Factor ($PF_{n,t}$)
Individual Protective Equipment (IPE)	1667
Collective Protection (ColPro)	3000

Suggested Types of Protection and Protection Factors for Vehicles and Shelters			
Vehicle/Shelter Ventilation Class	**Examples**	**Protection Type**	**Protection Factor ($PF_{n,t}$)**
Vehicle w/ColPro	155 mm SP, Recovery, ACE, M106 A2 4.2, M113, TOC	ColPro on Warning	3000
Vehicle w/ColPro	CBPS	ColPro Always On	3000
Vehicle w/o ColPro	4.2 MTR, CHAPP, 5-ton Van, Tent, Truck/Van	IPE	1667
Building w/ColPro	Admin Bldg, Control Bldg, ColPro Barracks	ColPro Always On	3000
Building w/o ColPro	Barracks, Hangar, Work Bldg	IPE	1667
In the Open	Dismounted, Foxhole	IPE	1667

Table A-7. Anthrax Dose Bins

Anthrax Dose Bin				
1	**2**	**3**	**4**	**5**
≤ 10^3 spores	10^3 to ≤ 10^4 spores	10^4 to ≤ 10^5 spores	10^5 to ≤ 10^6 spores	> 10^6 spores

E. Equations Pertinent To Exercise "Dread Night" Worksheet Calculations

The equations used or referred to during Exercise "Dread Night" are provided below, with accompanying variable definitions. Although the general equation is not provided in the worksheets, the calculations done in Session 1 are a step-wise variant of this equation, resulting in the same output, D_n.

1. General Equation for Calculating Dose/Dosage/Insult

$$D_n = \left(\sum_{t=t_0+1}^{t_{p,n}} \frac{C_{\text{cum},n,t} * EF_{n,t}}{SF_{n,t}} \right) + \left(\sum_{t=t_{p,n}+1}^{t_{end,n}} \frac{C_{\text{cum},n,t} * EF_{n,t}}{SF_{n,t} * PF_{n,t}} \right)$$

where:

n is the index number of the icon,

D_n is the dose/dosage/insult at Icon *n*,

$C_{\text{cum},n,t}$ is the cumulative agent or effect at Icon *n*, from time t-1 to t for $t > t_0$,

$EF_{n,t}$ is the exposure factor at Icon *n* from time t-1 to t for $t > t_0$,

$SF_{n,t}$ is the shielding factor at Icon *n* from time t-1 to t for $t > t_0$,

$PF_{n,t}$ is the physical protection factor at Icon *n* from time t-1 to t for $t > t_{p,n}$,

t_0 is the beginning of the event that results in exposure,

$t_{end,n}$ is the end of exposure time at Icon *n* (assumes $t_{end,n} \geq t_{p,n} + 1$), and

$t_{p,n}$ is the time at which physical protection is implemented at Icon *n*.

2. Shielding Factor Equation

$SF_{vent,n,t}$ = ———————————————————————

where:

n is the index number of the icon,

$SF_{vent,n,t}$ is the ventilation shielding factor at Icon *n* from time t-1 to t for $t > t_0$,

AER_n is the air exchange rate at Icon *n* [ACH],

$Duration_n$ is the length of time the cloud envelopes the vehicle/structure at Icon *n* [hr], and

$Occupancy_n$ is the length of time of vehicle/structure occupancy from the time of cloud arrival at Icon *n* [hr]. Note that occupancy must be greater than or equal to duration for shielding factors to apply.

3. Anthrax Probability of Infection Equation

$$p_{\text{E-Anth}}(d_n) = 1 - e^{-\lambda d_n}$$

where:

n is the index number of the icon,

$p_{\text{E-Anth}}(d_n)$ is the fraction of persons exposed to an anthrax dose d at Icon *n* who become ill (exposed and infected),

d_n is the anthrax dose at Icon *n* [spores], and

λ is the dose-response parameter [= 1.69×10^{-5}].

F. Session Worksheets

Step 1—Assignment of Dose Adjustment Factors

a. Exposure Factor

Using Table 4, assign activity level and associated exposure factor (EF)

EF = _____ (1)
(m^3/min)

b. Shielding Factor

1) Using Table 5, assign vehicle/shelter ventilation class and associated air exchange rate (AER)

AER = _____ (2)
(air changes per hour)

2) Using Table 2, determine duration of exposure (Duration)

Subtract last time dosage = 0 from time at which maximum dosage is reached

Duration = _____ (3)
(hr)

3) Determine duration of occupancy in the vehicle/shelter (Occupancy); since individuals remain in vehicle/shelter for duration of cloud transit, Occupancy = Duration

Occupancy = ___ (4)
(hr)

4) Using shielding factor equation below, calculate shielding factor (SF); if icon is unshielded set SF = 1

SF = _____ (5)

---

c. Protection Factor

If protection is available, use Table 6 to assign vehicle/shelter ventilation class and associated protection factor (PF); if no protection, set PF = 1

PF = _____ (6)

Determine time at which protection is initiated (t_p); if protection type is "ColPro Always On," set $t_p = 0$

t_p = _____ (7)
(min)

Step 2—Calculation of Cumulative Dosage Before and After Protection Is Initiated

a. From Table 2, determine total dosage

= _____ (8)
(spore-min/m^3)

b. From Table 2, determine cumulative dosage until the time at which protection is initiated (t_p) (Line 7)

= _____ (9)
(spore-min/m^3)

c. Calculate cumulative dosage after time protection is initiated

= = _____ (10)
(spore-min/m^3)

Step 3—Calculate Adjusted Dose

a. Calculate adjusted dose before protection

= _____ = _____ (11)
(spores)

b. Calculate adjusted dose after protection

= _____ = _____ (12)
(spores)

c. Calculate total adjusted dose (D)

D = _____ (13)
(spores)

Step 1—Calculate Number of Expected Ill

a. Vaccination

Determine proportion of individuals vaccinated

Determine anthrax vaccine efficacy factor (recommended value = 0.9)

Determine proportion of individuals protected = _____(1)

= _____(2)

From Table 1, determine number of individuals at icon

Determine number of protected individuals = _____(3)

= _____(4)

Determine number of unprotected individuals

= _____(5)

b. Infectivity

= _____(6)

Insert total adjusted dose (D) from Session 1 Calculation of Adjusted Anthrax Dose worksheet, Line 13

Using Anthrax Probability of Infection equation below, calculate probability of infection = _____(7) (spores)

= _____(8)

Calculate number of ill

= _____(9)

Step 2—Assign Dose Bin

Using Table 7, determine bin number associated with adjusted dose (D) (Line 7) = _____(10)

Step 3—Determine criterion for (WIA)

WIA(1) – anyone at Severity Level 1 or greater would be designated a casualty
WIA(2) – anyone at Severity Level 2 or greater would be designated a casualty
WIA(3) – anyone at Severity Level 3 or greater would be designated a casualty

Step 4—Determine onset of illness associated with WIA criterion

If WIA(1) or WIA(2), use Anthrax Lookup Table 1 (Session 2—Page 3). Multiply fraction of ill per day by number of estimated ill (Line 9) for assigned dose bin (Line 10)

If WIA(3), use Anthrax Lookup Table 2 (Session 2—Page 4). Multiply fraction of ill per day by number of estimated ill (Line 9) for assigned dose bin (Line 10)

Step 5—Determine time to death

Using Anthrax Lookup Table 3 (Session 2—Page 5), multiply fraction of ill per day by number of estimated ill (Line 9) for assigned dose bin (Line 10)

Number of ill: _____

Dose bin: _____

Anthrax Lookup Table 1 Fraction of Ill Who Enter Stage 1 of Illness on Specified Day (Severity Level 2)						
	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Number of Ill Per Day
Day	≤ 10^3 spores	10^3 < - ≤ 10^4 spores	10^4 < - ≤ 10^5 spores	10^5 < - ≤ 10^6 spores	> 10^6 spores	(Number expected ill times fraction per day)
0	0.0000	0.0000	0.0000	0.0000	0.0000	
1	0.0006	0.0006	0.0010	0.0084	0.7413	
2	0.0216	0.0326	0.0793	0.3779	0.2583	
3	0.0755	0.1242	0.2600	0.4400	0.0003	
4	0.1179	0.1814	0.2745	0.1386	0.0000	
5	0.1313	0.1778	0.1840	0.0286	0.0000	
6	0.1243	0.1444	0.1015	0.0052	0.0000	
7	0.1079	0.1066	0.0513	0.0010	0.0000	
8	0.0891	0.0749	0.0250	0.0002	0.0000	
9	0.0716	0.0512	0.0120	0.0000	0.0000	
10	0.0565	0.0345	0.0058	0.0000	0.0000	
11	0.0442	0.0231	0.0028	0.0000	0.0000	
12	0.0344	0.0155	0.0014	0.0000	0.0000	
13	0.0267	0.0104	0.0007	0.0000	0.0000	
14	0.0208	0.0071	0.0004	0.0000	0.0000	
15	0.0162	0.0048	0.0002	0.0000	0.0000	
16	0.0126	0.0033	0.0001	0.0000	0.0000	
17	0.0099	0.0023	0.0001	0.0000	0.0000	
18	0.0078	0.0016	0.0000	0.0000	0.0000	
19	0.0061	0.0011	0.0000	0.0000	0.0000	
20	0.0048	0.0008	0.0000	0.0000	0.0000	
21	0.0038	0.0005	0.0000	0.0000	0.0000	
22	0.0031	0.0004	0.0000	0.0000	0.0000	
23	0.0024	0.0003	0.0000	0.0000	0.0000	
24	0.0020	0.0002	0.0000	0.0000	0.0000	
25	0.0016	0.0001	0.0000	0.0000	0.0000	
26	0.0013	0.0001	0.0000	0.0000	0.0000	
27	0.0010	0.0001	0.0000	0.0000	0.0000	
28	0.0008	0.0001	0.0000	0.0000	0.0000	
29	0.0007	0.0000	0.0000	0.0000	0.0000	
30	0.0006	0.0000	0.0000	0.0000	0.0000	

Number of ill: _____

Dose bin: _____

Anthrax Lookup Table 2 Fraction of Ill Who Enter Stage 2 of Illness on Specified Day (Severity Level 4)						
	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Number of Ill Per Day
Day	≤ 10^3 spores	10^3 < - ≤ 10^4 spores	10^4 < - ≤ 10^5 spores	10^5 < - ≤ 10^6 spores	> 10^6 spores	(Number expected ill times fraction per day)
0	0.0000	0.0000	0.0000	0.0000	0.0000	
1	0.0000	0.0000	0.0000	0.0000	0.0000	
2	0.0000	0.0000	0.0000	0.0002	0.0132	
3	0.0007	0.0010	0.0023	0.0134	0.1296	
4	0.0066	0.0102	0.0236	0.0872	0.2290	
5	0.0234	0.0373	0.0774	0.1803	0.2127	
6	0.0489	0.0762	0.1358	0.2068	0.1537	
7	0.0746	0.1101	0.1645	0.1738	0.0999	
8	0.0929	0.1273	0.1585	0.1238	0.0621	
9	0.1012	0.1272	0.1317	0.0810	0.0380	
10	0.1005	0.1148	0.0994	0.0508	0.0232	
11	0.0934	0.0966	0.0703	0.0313	0.0142	
12	0.0829	0.0773	0.0477	0.0192	0.0088	
13	0.0711	0.0596	0.0315	0.0118	0.0055	
14	0.0594	0.0448	0.0204	0.0073	0.0035	
15	0.0488	0.0330	0.0131	0.0046	0.0022	
16	0.0396	0.0240	0.0084	0.0029	0.0014	
17	0.0318	0.0173	0.0054	0.0019	0.0009	
18	0.0254	0.0124	0.0034	0.0012	0.0006	
19	0.0202	0.0088	0.0022	0.0008	0.0004	
20	0.0160	0.0063	0.0014	0.0005	0.0003	
21	0.0127	0.0045	0.0009	0.0004	0.0002	
22	0.0100	0.0032	0.0006	0.0002	0.0001	
23	0.0079	0.0023	0.0004	0.0002	0.0001	
24	0.0063	0.0016	0.0003	0.0001	0.0001	
25	0.0050	0.0012	0.0002	0.0001	0.0000	
26	0.0040	0.0008	0.0001	0.0001	0.0000	
27	0.0032	0.0006	0.0001	0.0000	0.0000	
28	0.0025	0.0004	0.0001	0.0000	0.0000	
29	0.0020	0.0003	0.0000	0.0000	0.0000	
30	0.0016	0.0002	0.0000	0.0000	0.0000	

Number of expected ill: _____

Dose bin: _____

Anthrax Lookup Table 3						
Fraction of Ill Who Die on Specified Day						
	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5	Number of Fatalities Per Day
Day	≤ 10^3 spores	10^3 < - ≤ 10^4 spores	10^4 < - ≤ 10^5 spores	10^5 < - ≤ 10^6 spores	> 10^6 spores	(Number expected ill times fraction per day)
0	0.0000	0.0000	0.0000	0.0000	0.0000	
1	0.0000	0.0000	0.0000	0.0000	0.0000	
2	0.0000	0.0000	0.0000	0.0000	0.0022	
3	0.0002	0.0002	0.0005	0.0034	0.0560	
4	0.0026	0.0039	0.0092	0.0399	0.1701	
5	0.0126	0.0199	0.0434	0.1233	0.2148	
6	0.0325	0.0513	0.0985	0.1863	0.1851	
7	0.0575	0.0874	0.1438	0.1890	0.1335	
8	0.0799	0.1143	0.1589	0.1530	0.0884	
9	0.0944	0.1252	0.1465	0.1089	0.0561	
10	0.0997	0.1213	0.1195	0.0722	0.0350	
11	0.0971	0.1077	0.0898	0.0461	0.0217	
12	0.0893	0.0899	0.0637	0.0289	0.0135	
13	0.0788	0.0717	0.0435	0.0180	0.0084	
14	0.0673	0.0553	0.0289	0.0112	0.0053	
15	0.0562	0.0416	0.0189	0.0070	0.0034	
16	0.0462	0.0307	0.0123	0.0045	0.0022	
17	0.0374	0.0224	0.0079	0.0028	0.0014	
18	0.0301	0.0162	0.0051	0.0018	0.0009	
19	0.0240	0.0116	0.0033	0.0012	0.0006	
20	0.0191	0.0083	0.0021	0.0008	0.0004	
21	0.0152	0.0059	0.0014	0.0005	0.0003	
22	0.0120	0.0042	0.0009	0.0004	0.0002	
23	0.0095	0.0030	0.0006	0.0002	0.0001	
24	0.0076	0.0022	0.0004	0.0002	0.0001	
25	0.0060	0.0015	0.0003	0.0001	0.0001	
26	0.0048	0.0011	0.0002	0.0001	0.0000	
27	0.0038	0.0008	0.0001	0.0001	0.0000	
28	0.0030	0.0006	0.0001	0.0000	0.0000	
29	0.0024	0.0004	0.0001	0.0000	0.0000	
30	0.0019	0.0003	0.0000	0.0000	0.0000	

Step 1—Using output from appropriate Anthrax Lookup Table, fill in table below for each icon. Sum data in each column in bottom row.

Estimated Number of Anthrax Phase x Illnesses Per Day By Icon									
Icon	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 15 (Sum Days 8-15)	Day 30 (Sum Days 16-30)
1									
2									
3									
5									
6									
7									
9									
10									
11									
12									
13									
19									
30									
32									
38									
40									
Total									

Step 2—Using output from Anthrax Lookup Table A-3, fill in table below for each icon. Sum data in each column in bottom row.

Estimated Number of Anthrax Fatalities Per Day By Icon									
Icon	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 15 (Sum Days 8-15)	Day 30 (Sum Days 16-30)
1									
2									
3									
5									
6									
7									
9									
10									
11									
12									
13									
19									
30									
32									
38									
40									
Total									

Step 3—Report Casualties by Day

Given WIA severity level criterion:

If WIA(1) or WIA(2), copy values from totals row in Estimated Number of Anthrax Phase 1 Illnesses Per Day By Icon table to Moderate Anthrax Casualties row

If WIA(3) copy values from totals row in Estimated Number of Anthrax Phase 2 Illnesses Per Day By Icon table to Very Severe Anthrax Casualties row

Enter zeros in unused casualty rows

Sum casualty rows in shaded Total Casualties row

Copy values from totals row in Estimated Number of Fatalities per Day by Icon table (Step 2) to Delayed Fatalities row

Enter zeros in Prompt Fatalities row since biological agents are assumed to produce no Killed in Action (KIAs)

Sum values in KIA and Died of Wounds (DOW) in shaded Total Fatalities row

Estimated Number of Anthrax Casualties Per Day									
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 15	Day 30
Prompt Fatalities (KIA)									
Delayed Fatalities (DOW)									
Total Fatalities									
Mild Anthrax Casualties (Severity Level 1)									
Moderate Anthrax Casualties (Severity Level 2)									
Severe Anthrax Casualties (Severity Level 3)									
Very Severe Anthrax Casualties (Severity Level 4)									
Total Casualties (WIA(_))									

Step 4—Report Daily Casualty Rate

Using APOD Scenario table, determine population at risk (PAR)

Divide total number of new fatalities and casualties per day by PAR and multiply by 100; enter results in appropriate rows in the output table below

Estimated Number of Anthrax Casualties Per 100 Per Day									
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 15	Day 30
Prompt Fatalities (KIA)									
Delayed Fatalities (DOW)									
Total Fatalities									
Mild Anthrax Casualties (Severity Level 1)									
Moderate Anthrax Casualties (Severity Level 2)									
Severe Anthrax Casualties (Severity Level 3)									
Very Severe Anthrax Casualties (Severity Level 4)									
Total Casualties (WIA(_))									

Appendix B.
Working Group Outputs

In addition to the estimated numbers of casualties and fatalities over time, the exercise working groups generated a number of additional tables containing intermediate values used in various components of the methodology. These tables are provided in this appendix, as a record of the exercise and as an answer key for anyone wishing to run through the exercise materials on their own.

A. Group 1 Outputs

Table B-1. Group 1 Calculation of Anthrax Dose

Icon	Descriptor	People	Exposure Factor	Shielding Factor	Protection Factor	Total Dosage (spore-min/m^3)	Dosage Before Protection (spore-min/m^3)	Dosage After Protection (spore-min/m^3)	Adjusted Dose Before Protection (spores)	Adjusted Dose After Protection (spores)	Total Adjusted Dose (spores)
1	12 F-15C	38	0.030	1.76	1667	267	267	0	5	0	5
2	12 F-15C	84	0.030	1.58	1667	6,999,138	6,999,138	0	132,879	0	132,879
3	12 F-15C	84	0.030	1.76	1667	218,056	218,056	0	3,713	0	3,713
5	12 F-15E	38	0.030	1.00	1667	77,780,100	77,780,100	0	2,333,403	0	2,333,403
6	Billeting Population	48	0.015	12.68	1667	367,791,600	367,791,600	0	435,228	0	435,228
7	Billeting Population	98	0.015	12.68	1667	100,207	100,207	0	119	0	119
9	Billeting Population	98	0.015	12.68	1667	138,057,000	138,057,000	0	163,370	0	163,370
10	Billeting Population	98	0.015	12.68	1667	87,359,940	87,359,940	0	103,378	0	103,378
11	Billeting Population	166	0.015	10.28	1667	153,734,400	153,734,400	0	224,363	0	224,363
12	Billeting Population	166	0.015	12.68	1667	345,933	345,933	0	409	0	409
13	Bomb Dump	50	0.030	1.00	1667	514	514	0	15	0	15
19	F-15C	126	0.030	1.58	1667	101,457,360	101,457,360	0	1,926,170	0	1,926,170
30	S. Ops. Facility	50	0.015	4.53	1667	76,533,660	76,533,660	0	253,168	0	253,168
32	Tornado	248	0.030	1.46	1667	29,356,620	29,356,620	0	601,748	0	601,748
38	Tornado	37	0.030	1.58	1667	928	928	0	18	0	18
40	W. Fire Station	40	0.015	4.53	1667	49,668,900	49,668,900	0	164,301	0	164,301

Table B-2. Group 1 Calculation of Infectivity

Icon	Descriptor	X	Y	People	Fraction Vaccinated	Vaccine Efficacy	Adjusted Dose (spores)	Probability of Infection	Number of Expected Ill	Dose Bin
1	12 F-15C	55.3888	15.942	38	0	0.9	4.548846834	7.68726E-05	0.002921157	1
2	12 F-15C	56.3032	15.942	84	0	0.9	132878.7748	0.894141427	75.10787988	4
3	12 F-15C	55.846	15.942	84	0	0.9	3713.493245	0.060829308	5.109661885	2
5	12 F-15E	53.56	19.142	38	0	0.9	2333403	1	38	5
6	Billeting Population	53.1028	19.142	48	0	0.9	435228.1145	0.99936084	47.9693203	4
7	Billeting Population	53.1028	18.685	98	0	0.9	118.5802885	0.002002	0.196196019	1
9	Billeting Population	54.0172	18.685	98	0	0.9	163370.4734	0.936769026	91.80336453	4
10	Billeting Population	54.0172	18.228	98	0	0.9	103377.8421	0.825718859	80.92044821	4
11	Billeting Population	53.56	18.685	166	0	0.9	224362.5839	0.977443402	162.2556048	4
12	Billeting Population	53.56	18.228	166	0	0.9	409.3616258	0.006894336	1.144459733	1
13	Bomb Dump	55.846	18.228	50	0	0.9	15.414444	0.00026047	0.013023509	1
19	F-15C	56.3032	16.856	126	0	0.9	1926170.007	1	126	5
30	S. Ops. Facility	56.3032	16.399	50	0	0.9	253167.9308	0.986137086	49.30685428	4
32	Tornado	56.7604	16.856	248	0	0.9	601748.2004	0.99996168	247.9904967	4
38	Tornado	56.7604	17.771	37	0	0.9	17.61240683	0.000297605	0.011011399	1
40	W. Fire Station	54.4744	17.771	40	0	0.9	164301.206	0.937755829	37.51023315	4

Table B-3. Group 1 Calculation of Expected Casualties and Fatalities by Day for Icon 10

Anthrax Lookup Table 1				Anthrax Lookup Table 3		
Fraction of Ill Who Enter Stage 1 of Illness on Specified Day (Severity Level 2)				Fraction of Ill Who Die on Specified Day		
	Bin 4	Number of Ill Per Day			Bin 4	Number of Fatalities Per Day
Day	10^5< - ≤10^6 spores	(Number expected ill times fraction per day)		Day	10^5< - ≤10^6 spores	(Number expected ill times fraction per day)
0	0.0000	0.0000		0	0.0000	0.0000
1	0.0084	0.6804		1	0.0000	0.0000
2	0.3779	30.6099		2	0.0000	0.0000
3	0.4400	35.6400		3	0.0034	0.2754
4	0.1386	11.2266		4	0.0399	3.2319
5	0.0286	2.3166		5	0.1233	9.9873
6	0.0052	0.4212		6	0.1863	15.0903
7	0.0010	0.0810		7	0.1890	15.3090
8	0.0002	0.0162		8	0.1530	12.3930
9	0.0000	0.0000		9	0.1089	8.8209
10	0.0000	0.0000		10	0.0722	5.8482
11	0.0000	0.0000		11	0.0461	3.7341
12	0.0000	0.0000		12	0.0289	2.3409
13	0.0000	0.0000		13	0.0180	1.4580
14	0.0000	0.0000		14	0.0112	0.9072
15	0.0000	0.0000		15	0.0070	0.5670
16	0.0000	0.0000		16	0.0045	0.3645
17	0.0000	0.0000		17	0.0028	0.2268
18	0.0000	0.0000		18	0.0018	0.1458
19	0.0000	0.0000		19	0.0012	0.0972
20	0.0000	0.0000		20	0.0008	0.0648
21	0.0000	0.0000		21	0.0005	0.0405
22	0.0000	0.0000		22	0.0004	0.0324
23	0.0000	0.0000		23	0.0002	0.0162
24	0.0000	0.0000		24	0.0002	0.0162
25	0.0000	0.0000		25	0.0001	0.0081
26	0.0000	0.0000		26	0.0001	0.0081
27	0.0000	0.0000		27	0.0001	0.0081
28	0.0000	0.0000		28	0.0000	0.0000
29	0.0000	0.0000		29	0.0000	0.0000
30	0.0000	0.0000		30	0.0000	0.0000

Table B-4. Group 1 Estimated Number of Anthrax Stage 1 Illnesses Per Day, All Icons

Estimated Number of Anthrax Stage 1 Illnesses Per Day By Icon (Severity Level 2)									
Icon	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 15 (Sum Days 8-15)**	**Day 30 (Sum Days 16-30)**
1	0.0000	0.0001	0.0002	0.0003	0.0004	0.0004	0.0003	0.0011	0.0002
2	0.6309	28.3833	33.0475	10.4100	2.1481	0.3906	0.0751	0.0150	0.0000
3	0.0031	0.1666	0.6346	0.9269	0.9085	0.7378	0.5447	1.1318	0.0557
5	28.1694	9.8154	0.0114	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.4029	18.1276	21.1065	6.6485	1.3719	0.2494	0.0480	0.0096	0.0000
7	0.0001	0.0042	0.0148	0.0231	0.0258	0.0244	0.0212	0.0705	0.0115
9	0.7711	34.6925	40.3935	12.7239	2.6256	0.4774	0.0918	0.0184	0.0000
10	0.6797	30.5798	35.6050	11.2156	2.3143	0.4208	0.0809	0.0162	0.0000
11	1.3629	61.3164	71.3925	22.4886	4.6405	0.8437	0.1623	0.0325	0.0000
12	0.0007	0.0247	0.0864	0.1349	0.1503	0.1423	0.1235	0.4114	0.0670
13	0.0000	0.0003	0.0010	0.0015	0.0017	0.0016	0.0014	0.0047	0.0008
19	93.4038	32.5458	0.0378	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.4142	18.6331	21.6950	6.8339	1.4102	0.2564	0.0493	0.0099	0.0000
32	2.0831	93.7156	109.1158	34.3715	7.0925	1.2896	0.2480	0.0496	0.0000
38	0.0000	0.0002	0.0008	0.0013	0.0014	0.0014	0.0012	0.0040	0.0006
40	0.3151	14.1751	16.5045	5.1989	1.0728	0.1951	0.0375	0.0075	0.0000
Total	**128**	**342**	**350**	**111**	**24**	**5**	**1**	**2**	**0**

Table B-5. Group 1 Estimated Number of Anthrax Stage 1 Fatalities Per Day, All Icons

Estimated Number of Anthrax Fatalities Per Day By Icon									
Icon	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 15 (Sum Days 8-15)**	**Day 30 (Sum Days 16-30)**
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0002	0.0019	0.0007
2	0.0000	0.0000	0.2554	2.9968	9.2608	13.9926	14.1954	33.4455	0.9539
3	0.0000	0.0000	0.0010	0.0199	0.1017	0.2621	0.4466	3.7147	0.5580
5	0.0000	0.0836	2.1280	6.4638	8.1624	7.0338	5.0730	8.8084	0.2394
6	0.0000	0.0000	0.1631	1.9140	5.9146	8.9367	9.0662	21.3607	0.6092
7	0.0000	0.0000	0.0000	0.0005	0.0025	0.0064	0.0113	0.1300	0.0438
9	0.0000	0.0000	0.3121	3.6630	11.3194	17.1030	17.3508	40.8800	1.1659
10	0.0000	0.0000	0.2751	3.2287	9.9775	15.0755	15.2940	36.0339	1.0277
11	0.0000	0.0000	0.5517	6.4740	20.0061	30.2282	30.6663	72.2524	2.0606
12	0.0000	0.0000	0.0002	0.0030	0.0144	0.0372	0.0658	0.7584	0.2552
13	0.0000	0.0000	0.0000	0.0000	0.0002	0.0004	0.0007	0.0086	0.0029
19	0.0000	0.2772	7.0560	21.4326	27.0648	23.3226	16.8210	29.2068	0.7938
30	0.0000	0.0000	0.1676	1.9673	6.0795	9.1859	9.3190	21.9563	0.6262
32	0.0000	0.0000	0.8432	9.8948	30.5772	46.2006	46.8702	110.4302	3.1495
38	0.0000	0.0000	0.0000	0.0000	0.0001	0.0004	0.0006	0.0073	0.0025
40	0.0000	0.0000	0.1275	1.4967	4.6250	6.9882	7.0894	16.7033	0.4764
Total	**0**	**0**	**12**	**60**	**133**	**178**	**172**	**396**	**12**

Table B-6. Group 1 Estimated Number of Anthrax Casualties Per 100 Per Day

Estimated Number of Anthrax Casualties Per 100 Per Day									
	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 15**	**Day 30**
Prompt Fatalities (KIA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delayed Fatalities (DOW)	0.00	0.01	0.33	1.66	3.70	4.96	4.79	11.01	0.33
Total Fatalities	0.00	0.01	0.33	1.66	3.70	4.96	4.79	11.01	0.33
Mild Anthrax Casualties (Severity Level 1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Moderate Anthrax Casualties (Severity Level 2)	3.57	9.52	9.73	3.09	0.66	0.14	0.04	0.05	0.00
Severe Anthrax Casualties (Severity Level 3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Very Severe Anthrax Casualties (Severity Level 4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Casualties (WIA(1))	3.57	9.52	9.73	3.09	0.66	0.14	0.04	0.05	0.00

B. Group 2 Outputs

Table B-7. Group 2 Calculation of Anthrax Dose

Icon	Descriptor	People	Exposure Factor	Shielding Factor	Protection Factor	Total Dosage (spore-min/m^3)	Dosage Before Protection (spore-min/m^3)	Dosage After Protection (spore-min/m^3)	Adjusted Dose Before Protection (spores)	Adjusted Dose After Protection (spores)	Total Adjusted Dose (spores)
1	12 F-15C	38	0.0300	1.76	1667	267	0	267	0	0	0
2	12 F-15C	84	0.0300	1.58	1667	6,999,138	1	6,999,137	0	80	80
3	12 F-15C	84	0.0300	1.76	1667	218,056	7	218,049	0	2	2
5	12 F-15E	38	0.0300	1.00	1667	77,780,100	43,874,280	33,905,820	1,316,228	610	1,316,839
6	Billeting Population	48	0.0075	12.68	1667	367,791,600	356,622,600	11,169,000	211,006	4	211,010
7	Billeting Population	98	0.0075	12.68	1667	100,207	99,484	723	59	0	59
9	Billeting Population	98	0.0075	12.68	1667	138,057,000	60,978,660	77,078,340	36,080	27	36,107
10	Billeting Population	98	0.0075	12.68	1667	87,359,940	68,154,360	19,205,580	40,325	7	40,332
11	Billeting Population	166	0.0075	10.28	1667	153,734,400	135,802,800	17,931,600	99,096	8	99,104
12	Billeting Population	166	0.0075	12.68	1667	345,933	332,387	13,546	197	0	197
13	Bomb Dump	50	0.0300	1.00	1667	514	0	514	0	0	0
19	F-15C	126	0.0300	1.58	1667	101,457,360	352	101,457,008	7	1,155	1,162
30	S. Ops. Facility	50	0.0150	4.53	1667	76,533,660	662	76,532,998	2	152	154
32	Tornado	248	0.0150	1.58	1667	29,356,620	0	29,356,620	0	167	167
38	Tornado	37	0.0150	1.58	1667	928	0	928	0	0	0
40	W. Fire Station	40	0.0150	4.53	1667	49,668,900	30,437,820	19,231,080	100,686	38	100,724

Table B-8. Group 2 Calculation of Infectivity

Icon	Descriptor	X	Y	People	Fraction Vaccinated	Vaccine Efficacy	Adjusted Dose (spores)	Probability of Infection	Number of Expected Ill	Dose Bin
1	12 F-15C	55.3888	15.942	38	0	0.9	0.00286136	4.8357E-08	1.83757E-06	1
2	12 F-15C	56.3032	15.942	84	0	0.9	79.73037767	0.001346536	0.113109023	1
3	12 F-15C	55.846	15.942	84	0	0.9	2.344144367	3.96153E-05	0.003327681	1
5	12 F-15E	53.56	19.142	38	0	0.9	1316838.583	1	37.99999999	5
6	Billeting Population	53.1028	19.142	48	0	0.9	211009.5742	0.971733044	46.64318613	4
7	Billeting Population	53.1028	18.685	98	0	0.9	58.86251151	0.000994282	0.097439618	1
9	Billeting Population	54.0172	18.685	98	0	0.9	36107.06605	0.456762906	44.76276474	3
10	Billeting Population	54.0172	18.228	98	0	0.9	40332.22602	0.494200341	48.43163346	3
11	Billeting Population	53.56	18.685	166	0	0.9	99104.30111	0.812666099	134.9025725	3
12	Billeting Population	53.56	18.228	166	0	0.9	196.6709924	0.003318222	0.550824896	1
13	Bomb Dump	55.846	18.228	50	0	0.9	0.009246817	1.56271E-07	7.81356E-06	1
19	F-15C	56.3032	16.856	126	0	0.9	1162.147537	0.019448679	2.450533594	2
30	S. Ops. Facility	56.3032	16.399	50	0	0.9	154.0598991	0.002600226	0.130011292	1
32	Tornado	56.7604	16.856	248	0	0.9	167.1705883	0.002821196	0.699656575	1
38	Tornado	56.7604	17.771	37	0	0.9	0.005282666	8.9277E-08	3.30325E-06	1
40	W. Fire Station	54.4744	17.771	40	0	0.9	100724.3158	0.8177254	32.70901599	4

Table B-9. Group 2 Calculation of Expected Casualties and Fatalities by Day for Icon 10

Anthrax Lookup Table 1		
Fraction of Ill Who Enter Stage 1 of Illness on Specified Day (Severity Level 2)		
	Bin 3	Number of Ill Per Day
Day	10^4< - ≤10^5 spores	(Number expected ill times fraction per day)
0	0.0000	0.0000
1	0.0010	0.0484
2	0.0793	3.8406
3	0.2600	12.5922
4	0.2745	13.2944
5	0.1840	8.9114
6	0.1015	4.9158
7	0.0513	2.4845
8	0.0250	1.2108
9	0.0120	0.5812
10	0.0058	0.2809
11	0.0028	0.1356
12	0.0014	0.0678
13	0.0007	0.0339
14	0.0004	0.0194
15	0.0002	0.0097
16	0.0001	0.0048
17	0.0001	0.0048
18	0.0000	0.0000
19	0.0000	0.0000
20	0.0000	0.0000
21	0.0000	0.0000
22	0.0000	0.0000
23	0.0000	0.0000
24	0.0000	0.0000
25	0.0000	0.0000
26	0.0000	0.0000
27	0.0000	0.0000
28	0.0000	0.0000
29	0.0000	0.0000
30	0.0000	0.0000

Anthrax Lookup Table 3		
Fraction of Ill Who Die on Specified Day		
	Bin 3	Number of Fatalities Per Day
Day	10^4< - ≤10^5 spores	(Number expected ill times fraction per day)
0	0.0000	0.0000
1	0.0000	0.0000
2	0.0000	0.0000
3	0.0005	0.0242
4	0.0092	0.4456
5	0.0434	2.1019
6	0.0985	4.7705
7	0.1438	6.9644
8	0.1589	7.6958
9	0.1465	7.0952
10	0.1195	5.7876
11	0.0898	4.3491
12	0.0637	3.0851
13	0.0435	2.1068
14	0.0289	1.3997
15	0.0189	0.9154
16	0.0123	0.5957
17	0.0079	0.3826
18	0.0051	0.2470
19	0.0033	0.1598
20	0.0021	0.1017
21	0.0014	0.0678
22	0.0009	0.0436
23	0.0006	0.0291
24	0.0004	0.0194
25	0.0003	0.0145
26	0.0002	0.0097
27	0.0001	0.0048
28	0.0001	0.0048
29	0.0001	0.0048
30	0.0000	0.0000

Table B-10. Group 2 Estimated Number of Anthrax Stage 1 Illnesses Per Day, All Icons

Estimated Number of Anthrax Stage 1 Illnesses Per Day By Icon (Severity Level 2)									
Icon	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 15 (Sum Days 8-15)**	**Day 30 (Sum Days 16-30)**
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0001	0.0024	0.0085	0.0133	0.0149	0.0141	0.0122	0.0407	0.0066
3	0.0000	0.0001	0.0003	0.0004	0.0004	0.0004	0.0004	0.0012	0.0002
5	28.1694	9.8154	0.0114	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.3918	17.6265	20.5230	6.4647	1.3340	0.2425	0.0466	0.0093	0.0000
7	0.0001	0.0021	0.0074	0.0115	0.0128	0.0121	0.0105	0.0350	0.0057
9	0.0448	3.5497	11.6383	12.2874	8.2363	4.5434	2.2963	2.1620	0.0090
10	0.0484	3.8406	12.5922	13.2945	8.9114	4.9158	2.4845	2.3392	0.0097
11	0.1349	10.6978	35.0747	37.0308	24.8221	13.6926	6.9205	6.5158	0.0270
12	0.0003	0.0119	0.0416	0.0649	0.0723	0.0685	0.0594	0.1980	0.0322
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0015	0.0799	0.3044	0.4445	0.4357	0.3539	0.2612	0.5428	0.0267
30	0.0001	0.0028	0.0098	0.0153	0.0171	0.0162	0.0140	0.0467	0.0076
32	0.0004	0.0151	0.0528	0.0825	0.0919	0.0870	0.0755	0.2515	0.0409
38	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	0.2748	12.3607	14.3920	4.5335	0.9355	0.1701	0.0327	0.0065	0.0000
Total	**29**	**58**	**95**	**74**	**45**	**24**	**12**	**12**	**0**

Table B-11. Group 2 Estimated Number of Anthrax Stage 1 Fatalities Per Day, All Icons

Estimated Number of Anthrax Fatalities Per Day By Icon									
Icon	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 15 (Sum Days 8-15)**	**Day 30 (Sum Days 16-30)**
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0003	0.0014	0.0037	0.0065	0.0750	0.0252
3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0002	0.0022	0.0007
5	0.0000	0.0836	2.1280	6.4638	8.1624	7.0338	5.0730	8.8084	0.2394
6	0.0000	0.0000	0.1586	1.8611	5.7511	8.6896	8.8156	20.7702	0.5924
7	0.0000	0.0000	0.0000	0.0003	0.0012	0.0032	0.0056	0.0646	0.0217
9	0.0000	0.0000	0.0224	0.4118	1.9427	4.4091	6.4369	29.9776	1.5577
10	0.0000	0.0000	0.0242	0.4456	2.1019	4.7705	6.9645	32.4347	1.6854
11	0.0000	0.0000	0.0675	1.2411	5.8548	13.2879	19.3990	90.3443	4.6946
12	0.0000	0.0000	0.0001	0.0014	0.0069	0.0179	0.0317	0.3650	0.1228
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0005	0.0096	0.0488	0.1257	0.2142	1.7815	0.2676
30	0.0000	0.0000	0.0000	0.0003	0.0016	0.0042	0.0075	0.0862	0.0290
32	0.0000	0.0000	0.0001	0.0018	0.0088	0.0227	0.0402	0.4637	0.1560
38	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	0.0000	0.0000	0.1112	1.3051	4.0330	6.0937	6.1820	14.5653	0.4154
Total	**0**	**0**	**3**	**12**	**28**	**44**	**53**	**200**	**10**

Table B-12. Group 2 Estimated Number of Anthrax Casualties Per 100 Per Day

Estimated Number of Anthrax Casualties Per 100 Per Day									
	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 15**	**Day 30**
Prompt Fatalities (KIA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delayed Fatalities (DOW)	0.00	0.00	0.07	0.33	0.78	1.24	1.48	5.56	0.27
Total Fatalities	0.00	0.00	0.07	0.33	0.78	1.24	1.48	5.56	0.27
Mild Anthrax Casualties (Severity Level 1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Moderate Anthrax Casualties (Severity Level 2)	0.81	1.61	2.63	2.07	1.25	0.67	0.34	0.34	0.00
Severe Anthrax Casualties (Severity Level 3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Very Severe Anthrax Casualties (Severity Level 4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Casualties (WIA(1))	0.81	1.61	2.63	2.07	1.25	0.67	0.34	0.34	0.00

C. Group 3 Outputs

Table B-13. Group 3 Calculation of Anthrax Dose

Icon	Descriptor	People	Exposure Factor	Shielding Factor	Protection Factor	Total Dosage (spore-min/m^3)	Dosage Before Protection (spore-min/m^3)	Dosage After Protection (spore-min/m^3)	Adjusted Dose Before Protection (spores)	Adjusted Dose After Protection (spores)	Total Adjusted Dose (spores)
1	12 F-15C	38	0.0300	1.76	1667	267	267	0	5	0	5
2	12 F-15C	84	0.0300	1.58	1667	6,999,138	6,999,138	0	132,879	0	132,879
3	12 F-15C	84	0.0300	1.76	1667	218,056	218,056	0	3,713	0	3,713
5	12 F-15E	38	0.0300	1.00	1667	77,780,100	77,780,100	0	2,333,403	0	2,333,403
6	Billeting Population	48	0.0150	12.68	3000	367,791,600	0	367,791,600	0	145	145
7	Billeting Population	98	0.0150	12.68	1667	100,207	100,207	0	119	0	119
9	Billeting Population	98	0.0150	12.68	1667	138,057,000	138,057,000	0	163,370	0	163,370
10	Billeting Population	98	0.0150	12.68	1667	87,359,940	87,359,940	0	103,378	0	103,378
11	Billeting Population	166	0.0150	10.28	1667	153,734,400	153,734,400	0	224,363	0	224,363
12	Billeting Population	166	0.0150	12.68	1667	345,933	345,933	0	409	0	409
13	Bomb Dump	50	0.0300	1.00	1667	514	514	0	15	0	15
19	F-15C	126	0.0300	1.58	1667	101,457,360	101,457,360	0	1,926,170	0	1,926,170
30	S. Ops. Facility	50	0.0150	4.53	1667	76,533,660	76,533,660	0	253,168	0	253,168
32	Tornado	248	0.0300	1.46	1667	29,356,620	29,356,620	0	601,748	0	601,748
38	Tornado	37	0.0300	1.58	1667	928	928	0	18	0	18
40	W. Fire Station	40	0.0150	4.53	1667	49,668,900	49,668,900	0	164,301	0	164,301

Table B-14. Group 3 Calculation of Infectivity

Icon	Descriptor	X	Y	People	Fraction Vaccinated	Vaccine Efficacy	Adjusted Dose (spores)	Probability of Infection	Number of Expected Ill	Dose Bin
1	12 F-15C	55.3888	15.942	38	0.95	0.9	4.548846834	7.68726E-05	0.000423568	1
2	12 F-15C	56.3032	15.942	84	0.95	0.9	132878.7748	0.894141427	10.89064258	4
3	12 F-15C	55.846	15.942	84	0.95	0.9	3713.493245	0.060829308	0.740900973	2
5	12 F-15E	53.56	19.142	38	0.95	0.9	2333403	1	5.51	5
6	Billeting Population	53.1028	19.142	48	0.95	0.9	145.0760382	0.002448782	0.017043522	1
7	Billeting Population	53.1028	18.685	98	0.95	0.9	118.5802885	0.002002	0.028448423	1
9	Billeting Population	54.0172	18.685	98	0.95	0.9	163370.4734	0.936769026	13.31148786	4
10	Billeting Population	54.0172	18.228	98	0.95	0.9	103377.8421	0.825718859	11.73346499	4
11	Billeting Population	53.56	18.685	166	0.95	0.9	224362.5839	0.977443402	23.52706269	4
12	Billeting Population	53.56	18.228	166	0.95	0.9	409.3616258	0.006894336	0.165946661	1
13	Bomb Dump	55.846	18.228	50	0.95	0.9	15.414444	0.00026047	0.001888409	1
19	F-15C	56.3032	16.856	126	0.95	0.9	1926170.007	1	18.27	5
30	S. Ops. Facility	56.3032	16.399	50	0.95	0.9	253167.9308	0.986137086	7.14949387	4
32	Tornado	56.7604	16.856	248	0.95	0.9	601748.2004	0.99996168	35.95862202	4
38	Tornado	56.7604	17.771	37	0.95	0.9	17.61240683	0.000297605	0.001596653	1
40	W. Fire Station	54.4744	17.771	40	0.95	0.9	164301.206	0.937755829	5.438983806	4

Table B-15. Group 3 Calculation of Expected Casualties and Fatalities by Day for Icon 10

Anthrax Lookup Table 1			Anthrax Lookup Table 3		
Fraction of Ill Who Enter Stage 1 of Illness on Specified Day (Severity Level 2)			Fraction of Ill Who Die on Specified Day		
	Bin 4	Number of Ill Per Day		Bin 4	Number of Fatalities Per Day
Day	10^5< - ≤10^6 spores	(Number expected ill times fraction per day)	Day	10^5< - ≤10^6 spores	(Number expected ill times fraction per day)
0	0.0000	0.0000	0	0.0000	0.0000
1	0.0084	0.0986	1	0.0000	0.0000
2	0.3779	4.4341	2	0.0000	0.0000
3	0.4400	5.1627	3	0.0034	0.0399
4	0.1386	1.6263	4	0.0399	0.4682
5	0.0286	0.3356	5	0.1233	1.4467
6	0.0052	0.0610	6	0.1863	2.1859
7	0.0010	0.0117	7	0.1890	2.2176
8	0.0002	0.0023	8	0.1530	1.7952
9	0.0000	0.0000	9	0.1089	1.2778
10	0.0000	0.0000	10	0.0722	0.8472
11	0.0000	0.0000	11	0.0461	0.5409
12	0.0000	0.0000	12	0.0289	0.3391
13	0.0000	0.0000	13	0.0180	0.2112
14	0.0000	0.0000	14	0.0112	0.1314
15	0.0000	0.0000	15	0.0070	0.0821
16	0.0000	0.0000	16	0.0045	0.0528
17	0.0000	0.0000	17	0.0028	0.0329
18	0.0000	0.0000	18	0.0018	0.0211
19	0.0000	0.0000	19	0.0012	0.0141
20	0.0000	0.0000	20	0.0008	0.0094
21	0.0000	0.0000	21	0.0005	0.0059
22	0.0000	0.0000	22	0.0004	0.0047
23	0.0000	0.0000	23	0.0002	0.0023
24	0.0000	0.0000	24	0.0002	0.0023
25	0.0000	0.0000	25	0.0001	0.0012
26	0.0000	0.0000	26	0.0001	0.0012
27	0.0000	0.0000	27	0.0001	0.0012
28	0.0000	0.0000	28	0.0000	0.0000
29	0.0000	0.0000	29	0.0000	0.0000
30	0.0000	0.0000	30	0.0000	0.0000

Table B-16. Group 3 Estimated Number of Anthrax Stage 1 Illnesses Per Day, All Icons

Estimated Number of Anthrax Stage 1 Illnesses Per Day By Icon (Severity Level 2)									
Icon	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 15 (Sum Days 8-15)**	**Day 30 (Sum Days 16-30)**
1	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0002	0.0000
2	0.0915	4.1156	4.7919	1.5094	0.3115	0.0566	0.0109	0.0022	0.0000
3	0.0004	0.0242	0.0920	0.1344	0.1317	0.1070	0.0790	0.1641	0.0081
5	4.0846	1.4232	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0004	0.0013	0.0020	0.0022	0.0021	0.0018	0.0061	0.0010
7	0.0000	0.0006	0.0021	0.0034	0.0037	0.0035	0.0031	0.0102	0.0017
9	0.1118	5.0304	5.8571	1.8450	0.3807	0.0692	0.0133	0.0027	0.0000
10	0.0986	4.4341	5.1627	1.6263	0.3356	0.0610	0.0117	0.0023	0.0000
11	0.1976	8.8909	10.3519	3.2609	0.6729	0.1223	0.0235	0.0047	0.0000
12	0.0001	0.0036	0.0125	0.0196	0.0218	0.0206	0.0179	0.0597	0.0097
13	0.0000	0.0000	0.0001	0.0002	0.0002	0.0002	0.0002	0.0007	0.0001
19	13.5436	4.7191	0.0055	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.0601	2.7018	3.1458	0.9909	0.2045	0.0372	0.0071	0.0014	0.0000
32	0.3021	13.5888	15.8218	4.9839	1.0284	0.1870	0.0360	0.0072	0.0000
38	0.0000	0.0000	0.0001	0.0002	0.0002	0.0002	0.0002	0.0006	0.0001
40	0.0457	2.0554	2.3932	0.7538	0.1556	0.0283	0.0054	0.0011	0.0000
Total	**19**	**47**	**48**	**15**	**3**	**1**	**0**	**0**	**0**

Table B-17. Group 3 Estimated Number of Anthrax Stage 1 Fatalities Per Day, All Icons

Estimated Number of Anthrax Fatalities Per Day By Icon									
Icon	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 15 (Sum Days 8-15)**	**Day 30 (Sum Days 16-30)**
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0001
2	0.0000	0.0000	0.0370	0.4345	1.3428	2.0289	2.0583	4.8496	0.1383
3	0.0000	0.0000	0.0001	0.0029	0.0147	0.0380	0.0648	0.5386	0.0809
5	0.0000	0.0121	0.3086	0.9373	1.1835	1.0199	0.7356	1.2772	0.0347
6	0.0000	0.0000	0.0000	0.0000	0.0002	0.0006	0.0010	0.0113	0.0038
7	0.0000	0.0000	0.0000	0.0001	0.0004	0.0009	0.0016	0.0189	0.0063
9	0.0000	0.0000	0.0453	0.5311	1.6413	2.4799	2.5159	5.9276	0.1691
10	0.0000	0.0000	0.0399	0.4682	1.4467	2.1859	2.2176	5.2249	0.1490
11	0.0000	0.0000	0.0800	0.9387	2.9009	4.3831	4.4466	10.4766	0.2988
12	0.0000	0.0000	0.0000	0.0004	0.0021	0.0054	0.0095	0.1100	0.0370
13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0013	0.0004
19	0.0000	0.0402	1.0231	3.1077	3.9244	3.3818	2.4390	4.2350	0.1151
30	0.0000	0.0000	0.0243	0.2853	0.8815	1.3320	1.3513	3.1837	0.0908
32	0.0000	0.0000	0.1223	1.4347	4.4337	6.6991	6.7962	16.0124	0.4567
38	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0011	0.0004
40	0.0000	0.0000	0.0185	0.2170	0.6706	1.0133	1.0280	2.4220	0.0691
Total	**0**	**0**	**2**	**8**	**18**	**25**	**24**	**54**	**2**

Table B-18. Group 3 Estimated Number of Anthrax Casualties Per 100 Per Day

Estimated Number of Anthrax Casualties Per 100 Per Day									
	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 15**	**Day 30**
Prompt Fatalities (KIA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delayed Fatalities (DOW)	0.00	0.00	0.05	0.23	0.51	0.68	0.66	1.51	0.05
Total Fatalities	0.00	0.00	0.05	0.23	0.51	0.68	0.66	1.51	0.05
Mild Anthrax Casualties (Severity Level 1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Moderate Anthrax Casualties (Severity Level 2)	0.52	1.31	1.33	0.42	0.09	0.02	0.01	0.01	0.00
Severe Anthrax Casualties (Severity Level 3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Very Severe Anthrax Casualties (Severity Level 4)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Casualties (WIA(2))	0.52	1.31	1.33	0.42	0.09	0.02	0.01	0.01	0.00

Appendix C.
Tabletop Exercise Attendees

Chairman

Group Captain Clare Walton

Military Committee Medical Standardization Board Committee of the Chiefs of Military Medical Services (MCMEDSB COMEDS) Co-Chair

Colonel Wynand Korterink

Secretary

Lieutenant Colonel Jean-Christophe Dias

North Atlantic Treaty Organization Nations

Belgium

Commandant Dirk Dons

Adjutant Chief Dirk Pauwels

Canada

Lieutenant Colonel Ron Wojtyk

Czech Republic

Colonel Jiri Kassa

France

Colonel Frederic Dorandeu

Colonel François Thibault

Mr. Francis Herodin

Germany

Major Frank Balszuweit

Captain Thomas Michelis

Hungary

Mr. Gyozo Horvath

Italy

Colonel Vincenzo La Gioia

Netherlands

Commander Jaap Boreel

Mr. Ad de Koning

Mrs. Marijke Valstar

Mr. Hugo-Jan Jansen

Major George Van Leeuwen

Norway

Mr. Bjoern Peter Berdal

Mr. Per Ballangrud

Poland

Colonel Oktawiusz Antkowiak

Turkey

Captain Sermet Sezigen

United Kingdom

Lieutenant Colonel Andrew Charnick

Commander Steven Bland

United States

Lieutenant Colonel Craig Moss

Colonel Theodore Cieslak

Lieutenant Colonel Robert Von Tersch

Lieutenant Commander Thomas Bosy

Captain Sean Chickery

Mr. James Smith

Mr. Carl Curling

Ms. Julia Burr

Mr. Lucas LaViolet

Ms. Nancy Nurthen

Ms. Corinne Ringholz

Commands

Allied Command Operations (ACO)

Captain Paul Vitart

Non-NATO Nations

Austria

Colonel Alois Benc

Finland

Mr. Tapio Kuitunen

Switzerland

Colonel Sergei Bankoul

Other Delegates

European Union Military Staff (EUMS)

Lieutenant Colonel Bernd Wagner

Appendix D.
Abbreviations

AER	Air Exchange Rate
AMedP-8(C)	Allied Medical Publication 8(C)
APOD	Air Port of Disembarkation
CBRN	Chemical, Biological, Radiological and Nuclear
CP	Collective Protection
DOW	Died of Wounds
EF	Exposure Factor
IPE	Individual Protective Equipment
ISAF	International Security Assistance Force
JRO	Joint Requirements Office
KIA	Killed in Action
NATO	North Atlantic Treaty Organization
OTSG	(U.S. Army) Office of the Surgeon General
PAR	Population At Risk
PF	Protection Factor
SF	Shielding Factor
SOCOM	Special Operations Command
TTX	Tabletop Exercise
VLSTRACK	Vapor, Liquid, and Solid Tracking Computer Model
WIA	Wounded in Action

Appendix E.
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References

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Institute for Defense Analyses
4850 Mark Center Drive
Alexandria, VA 22311-1882

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Office of the Army Surgeon General
ATTN: DASG-HCO (MCOP-P)
5111 Leesburg Pike, Suite 401A
Falls Church, VA 22041-3258

Chief, Medical Branch
Joint Requirements Office-CBRN Defense
J-8, Joint Staff
Pentagon, Washington, DC 20301

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14. ABSTRACT

The U.S. Army Office of the Surgeon General (OTSG) tasked IDA with planning and conducting "Dread Night," a tabletop exercise in which participants were expected to develop a casualty estimate for a planning scenario involving an anthrax attack against NATO forces located in and around Kabul International Airport in Afghanistan. The exercise was designed to promote familiarity and understanding of the casualty estimation methodology contained in *Allied Medical Publication 8(C): NATO Planning Guide for the Estimation of CBRN Casualties (AMedP-8(C))*. This exercise was conducted as part of the 31st meeting of the NATO Military Committee Medical Standardization Board Chemical, Biological, Radiological and Nuclear (CBRN) Medical Working Group, held 1–3 February 2010 at NATO headquarters in Brussels, Belgium. This paper documents IDA's work in the development of the exercise, the conduct of the exercise itself, and the results. Exercise scripts, worksheets, background materials and outputs are provided as Appendices.

15. SUBJECT TERMS

Casualty estimation, CBRN, modeling, exercise, medical planning, AMedP-8

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